SCIENCE

VOL. 94 FRIDAY, DECEMBER 12, 1941 No. 2450

The American Philosophical Society: PROFESSOR EDWIN G. CONKLIN 547

Obituary:
Rudolf Schoenheimer: DR. HANS T. CLARKE. *Deaths and Memorials* 553

Scientific Events:
The Shortage of Physicians in the United States; The National Malaria Committee; Resignation of Dr. Rappleye as Commissioner of the Department of Hospitals of the City of New York; The American Society of Mechanical Engineers; Award to the Dow Chemical Company; Awards of the Charles Frederick Chandler Medal 555

Scientific Notes and News 557

Discussion:
The Role of the Burrowing Owl and the Sticktight Flea in the Spread of Plague: DR. C. M. WHEELER, DR. J. R. DOUGLAS and DR. F. C. EVANS. *The Term "Euthenics":* PROFESSOR CARL E. SEASHORE. *One Unusual Observation in the Auroral Display of September 18:* DR. F. C. BROWN 560

Quotations:
Chemists and the National Defense 563

Scientific Books:
Industrial Poisons: DR. RALPH W. MCKEE. *Algebra:* DR. A. A. ALBERT 565

Societies and Meetings:
The Indiana Academy of Science: PROFESSOR WILL E. EDINGTON 565

Special Articles:
Experimental Air-Borne Infection with Poliomyelitis Virus: DR. HAROLD K. FABER and DR. ROSALIE J. SILVERBERG. *Inhibitory Effects of Sulfonamides on Cultures of Actinomyces Hominis:* PROFESSOR WINDSOR C. CUTTING and DR. LOUIS P. GEBHARDT 566

Scientific Apparatus and Laboratory Methods:
An Apparatus for Roller Tube Tissue Culture: DR. DALE REX COMAN and DR. N. GRAHAM STABLER 569

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AUTUMN GENERAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY, NOVEMBER 21–22, 1941

By Dr. EDWIN G. CONKLIN

VICE-PRESIDENT AND EXECUTIVE OFFICER

DURING the eighteenth and nineteenth centuries the meetings of the American Philosophical Society were held on the first and third Fridays of each month from October to May, inclusive, and the scientific programs consisted of a principal lecture and minor verbal or written communications from local members or distant correspondents. With the removal of residence of local members from the center of Philadelphia and the wider geographical distribution of the membership of the society it became increasingly difficult to get good attendance at these fortnightly meetings, and in the early years of the present century the regular meetings began to be held monthly, while an annual general meeting was held in the month of April extending over a period of two or three days. The success of these general meetings was so great and the interest in the monthly meetings so small that the latter were abandoned in 1935 and in their place an Autumn General Meeting in the month of November was instituted, to which there was soon added a Midwinter Meeting in the month of February, each of these extending over two full days. By thus decreas-

ing the number of meetings and increasing the length and importance of each the attendance and interest have greatly increased.

The Autumn General Meeting for 1941 was held in the Hall of the Society on Independence Square on November 21 and 22. About one hundred and ten (110) members and especially invited guests were present and registered in addition to an unknown number of persons who were present but did not register. The program of the first day of the meeting consisted of reports on the scientific results of the United States Antarctic Expedition of 1939–1941. In the main these were the first detailed reports of this latest expedition to Antarctica, which was probably better organized for scientific work than any previous expedition. Thanks are due to all who took part in this program, and especially to Dr. Serge A. Korff, who was largely responsible for its organization. Brief abstracts of these reports follow:

F. Alton Wade, senior scientist, U. S. Antarctic Service. An Introduction to the Symposium on Scientific Results of the United States Antarctic Expedition, 1939–41.

One of the primary purposes of the United States Antarctic Service Expedition, 1939–1941, was to carry on a comprehensive program of scientific observations and research. Through the cooperation of many of the world's leading scientists such a program was planned. A good portion of the program was carried to completion by the twenty-one members of the scientific staff. Due to extenuating circumstances and an unexpected termination of the expedition, some phases were only partially completed. Detailed observations were made and programs of research were conducted in the following fields: Auroral phenomena, bacteriology, botany, cosmic ray, glaciology, magnetism, medicine, meteorology, micropaleontology, ornithology, petrography and petrology, physiography, physiology, radio, seismology, structural geology and zoology. A few of the reports have been completed, others are nearing completion and some will not be ready for publication for months. In addition to the work as summarized in this symposium, there are to be published many more reports. Among them may be listed the following: Observations and height determinations of the Aurora Australis. The physiographic feature of the Ross Shelf Ice. The geology of the Weddell Coast of Palmer Peninsula south of 68°. The geological features and formations in the vicinity of East Base. The sedimentary rocks of the Edsel Ford Mountains. The petrography and structure of the Rockefeller Mountains. Ornithology Report; this will include observations of bird life at both bases, at the Melchior Islands and along the ships' routes. The petrography and structure of the Melchior Islands. A correlation of radio receiving and transmitting conditions with magnetic phenomena and auroral displays.

F. Alton Wade. The Physical Aspects of Shelf Ice.

The first detailed investigations of shelf ice were made at West Base during 1940. Included in the program were the following: the variation of the density of the firn with depth, sub-surface temperature measurements to a depth of forty-one meters, variations in the snow surface level over a period of eleven months, horizontal and vertical movements within the firn, variations in the size of the constituent grains in various zones, stratification and horizontal banding. The methods used are discussed and the apparatus is described. The results are presented in tabular and graphic forms. Comparisons are made with the results as obtained from investigations of the physical aspects of other types of glaciers; namely, valley glaciers and the Greenland Ice Cap. The lack of summer melt-water in the Ross Shelf Ice eliminated what had been considered the most important factor in the process of firnification. However, without the aid of melt-water the process does proceed with much the same results. An explanation of the firnification process in regions where the air temperature seldom rises above freezing is advanced.

Paul A. Siple, geographer and leader, West Base. Geographical Discoveries from West Base.

Geographical exploration was carried on from West Base in 1940 by means of five reconnaissance field parties and two aircraft. The routes used followed but extended considerably beyond those opened first by the Byrd Expeditions 1929 and 1934. The field parties' operations were limited to the hinter coastal mountains east of Little America from longitude 164° west to longitude 136° west. The parties were occupied mainly with surveying, geology, biology and meteorology. Aerial reconnaissance and surveying extended eastward to longitude 120° west including the major land features to nearly 200 miles south of the coast. This was accomplished by six flights making more than 1,000 usable aerial survey photographs available of the area. Exploration to the west of Little America included three major flights over previously explored portions of the Ross Ice Shelf crossing in each case into meridians of east longitude in the vicinity of latitude 78° 30′; 79° 20′; 81°; 83°; and 84°. Four newly discovered areas of internal disturbance were studied and 15 bays and inlets were photographed in the continuous aerial survey of about 400 miles of barrier face from an altitude of 7,000 feet. Southern exploratory operations were confined mainly to filling in the gap of mountains in the Austral Cordillera between Beardmore and Live Glaciers. However, the character of land formations east to the 120th meridian west indicated no sea level connections between the Ross and Weddell Seas. Other geographical accomplishments included glacial studies of the formation and physiography of shelf ice; problems of human adaptation to the climate of Antarctica and studies of the cooling power of the wind.

Lawrence A. Warner, Department of Geology, the Johns Hopkins University. Geological Structure and Petrography of the Edsel Ford Ranges, Marie Byrd Land, Antarctica.

The portion of the Edsel Ford Ranges investigation by the geological party of the U. S. Antarctic Expedition lies between longitudes 143° 30′ and 145° 30′ W and

latitudes 76° 50′ and 77° 15′ S and comprises a total area of about 700 square miles. The Raymond Fosdick Mountains, immediately to the north, were investigated by a party of biologists who submitted their geological notes and specimens for investigation. Thus, reconnaissance data are available for the major portion of the Edsel Ford Ranges. The oldest outcropping rocks in the area are slightly metamorphosed sediments which consist of a remarkably uniform series of dark shales and sandstones, the total thickness of which is at least 15,000 feet. Since no fossils were found, the geological age of the series is not known. The sediments are intruded by a granitic batholith, the major axis of which appears to run roughly N–S. The major sedimentary ranges comprise a broad syncline, the axis of which trends E–W and plunges down the west flank of the batholith. Exposed contacts between granite and sediments are for the most part sharp and concordant. Dikes and linear masses of igneous material, ranging in composition from alaskite to dolerite are intrusive into the granite and sediments. These are thought to represent differentiates of the granitic magma. The region as a whole is broken by faults, along one of which there is a horizontal displacement of over a thousand feet. The strikes of the dikes and faults appear to be symmetrical to the major structures in the granite and sediments. Of relatively recent origin are basaltic lava flows which seem to be confined to a small area in the Raymond Fosdick Mountains. The major geological problems of the area are concerned with: (1) The age of the sediments and the climatic and geographic conditions under which they were deposited. (2) The mode of emplacement of the igneous bodies and the relation of the intrusives to the deformation of the area. (3) The paucity of ore deposition and pegmatization. A critical analysis of the field evidence and detailed petrographic studies in the laboratory are now in progress in the hope of shedding light on these problems.

H. G. Dorsey, Jr., U. S. Weather Bureau. An Antarctic Mountain Weather Station.

The meteorological program at the East Base of the U. S. Antarctic Expedition was featured by the establishment of a completely equipped weather outpost over a mile above sea-level on the plateau of Palmer Peninsula. Early in August, 1940, a sledging party from East Base pioneered a route to the plateau, making an ascent which previous explorers considered inaccessible to dog teams, and indicating the possibility of erecting a mountain weather station. Late in October, nearly one and a half tons of equipment were transported by four dog teams to the proposed meteorological outpost, located at 68° 7′ S., 66° 30′ W. on a plateau knoll about 12 miles east of the main base. Lester Lherke, C.B.M., U.S.N., and Robert Palmer occupied the plateau weather station during November and December. Despite prevailing northeasterly storms of drifting snow, their days were well spent between living quarters in a sturdy tent and meteorological office in a snow cave. For the first time in South Polar regions, detailed high level weather data were obtained in a form suitable for comparison with nearby sea-level observations. Six-hourly check readings on all data were taken concurrently with those at East Base, in addition to the continuous autographic records of wind, pressure and temperature. Snow accretion and ablation were measured. Pilot balloon observations of the winds aloft were especially valuable when there was a low overcast below the plateau. The mountain station contacted the base twice daily by low power radio, sending coded weather reports, which were included in the East Base weather transmissions to South America. These data and frequent special reports were helpful in forecasting for aviation operations at East Base and provide interesting material for future research on the meteorological phenomena of Palmer Peninsula.

Roy G. Fitzsimmons, Physicist, Department of Terrestrial Magnetism, Carnegie Institution of Washington. Preliminary Report on the Magnetic and Seismic Program.

During the period from April 27, 1940, to January 21, 1941, a LaCour insensitive magnetograph was in operation at Little America. Variations of the declination and the horizontal and vertical components of the earth's magnetic field were recorded. Control observations were made with a magnetometer and a dip circle. A general description of the magnetic observatory and the method of observation as well as a report on the preliminary magnetic results were given. During the period from November 17, 1940, to December 28, 1940, a McComb-Romberg seismograph was in operation at the Rockefeller Mountains. A report of the earthquakes recorded and their analysis were given.

Serge A. Korff, assistant professor of physics, New York University. Report on Cosmic Ray Results.

The cosmic ray program of the U. S. Antarctic Service was planned with a view to throwing further light on the connections between cosmic rays and meteorology, and also on the effects produced by such high energy rays passing through matter. The first part of the program involved the operation of two meters at West Base over the Antarctic winter and a correlation of the records there obtained with temperature, pressure and other effects, such as magnetic variations, and also the operation of the instrument on board ship to obtain further data regarding the temperature coefficient and the latitude-variation. Finally, airplane flights to high altitudes were carried out, which were to be studied in connection with radiosonde data. The second part, namely, studying the effects produced by the radiation, involved (a) operating a cosmic-ray counter on shipboard for comparison with the electroscope data, (b) the operation of a neutron counter and (c) measurement of all bursts in the cosmic ray intensity on the long-term records. With respect to the first part, a pressure coefficient was determined from the data at West Base for each 15-day period of operation. It was found that the least-square solutions of the correlation between pressure and cosmic-ray intensity gave a slope (the pressure coefficient) and an intercept (the extrapolation of the cosmic ray intensity to zero pressure) both of which varied over somewhat wider limits than were anticipated. Further analysis showed that this variation was associated with changes in the light of the mesotron producing layer, but that contrary to the usual

procedure in temperature latitudes, this could not be represented as an external temperature-effect. This was found to be due to the fact that the surface temperature was not a good indicator of the distribution of the atmosphere in the column of air above the instrument. Using the radiosonde data, a new dependence upon upper atmosphere conditions was computed, and better agreement was obtained. This was checked by the runs made on shipboard in zones of different surface temperatures. It is a pleasure to acknowledge the excellent work done by Messrs. E. T. Clarke, D. K. Bailey and E. K. Smith in this connection.

Arnold Court, junior meteorologist, U. S. Weather Bureau. Disappearance of the Tropopause During the Antarctic Winter.

Complete disappearance of the tropopause above Little America III is revealed by the 190 radiosonde observations made from April 25, 1940, to January 15, 1941, as part of the U. S. Weather Bureau's share in the scientific program of the U. S. Antarctic Service. Summertime observations show a definite and rather warm (−50° C) tropopause around 9 km, above which the stratosphere is −40° C or warmer. Spring and fall soundings clearly show the transition from the winter type, with no clearly defined stratosphere and with temperatures to −80° C, to the summer condition. This hitherto unsuspected behavior of the upper air apparently is due to seasonal differences in radiation, but no indications of such conditions have so far been reported in the northern hemisphere, despite daily soundings at Barrow, Nome, Fairbanks and other Alaskan stations, and intensive work in Russia and Scandinavia. None of these stations, however, is as close to the pole as Little America III (800 miles). Another phase of the meteorological program, the making of 230 pilot balloon ascents, revealed the prevailing summertime wind at high levels to be southwest or west-southwest, not northwest as had previously been assumed. On the surface, observations covering an entire year were obtained, 11 months of them on a complete 4-a-day basis. Barograms were obtained in duplicate for the entire time, and thermograms except when winter cold stopped clocks. Complete wind records minute by minute were obtained from April 10 to camp abandonment on February 1.

Herwil M. Bryant, Naval Research Laboratory, Anacostia Station. Biology at East Base.

The East Base of the U. S. Antarctic Service is well situated for biological study. Stonington Island, the base of operations, lies just a hundred statute miles within the Antarctic Circle on the west coast of the Palmer Peninsula. Here great glaciers flow down to the sea between high mountains. Precipitous cliffs, many too steep to hold snow, form the shore line. Although frozen-over eleven months of the year, the relatively shallow waters along the coast are rich in marine life, attracting penguin and seal alike. During summer months sea birds are attracted to this feeding ground; some breed on the rocky shore. Two Adelie penguins' rookeries were within sledging distance of the base. Rocks exposed on the steep cliffs were often encrusted with lichens, while thawing weather during the short summer period formed small pools of fresh water, often teeming with aquatic life. The collection of a completely representative set of specimens representing this region was a primary consideration. The U. S. National Museum has received all specimens brought back. At the present time these are undergoing exhaustive classification and investigation. In the field, a thorough study of the breeding Adelie penguin was made. Carl R. Eklund, ornithologist and assistant biologist, made studies on the body temperatures of Antarctic birds. New southern records were recorded for sub-Antarctic species such as the blue-eyed shag (*Phalacrocorax atriceps*), and the breeding southern black-backed gull (*Larus dominicanus*). Of special interest were notes on Collembola colonies and the discovery of certain mites living upon lichens, algae and mosses. At East Base, the first representative West Antarctica biological collection was prepared for an American institution and a general biological picture of this unknown region, adding to the work of Bertram and Roberts of the British Graham Land Expedition (1935–1937), was recorded.

Ernest E. Lockhart, physiologist, Massachusetts Institute of Technology. Acclimatization in the Antarctic.

An attack on the problem of acclimatization by white men in the Antarctic was made by studying the effect of sudden changes in temperature on blood pressure, heart rate and respiration rate. This work was extended with data on typical body temperature, blood pressure, heart and respiration rates and metabolism under basal conditions. A study of blood sugar levels was also made. The results of these studies may be summarized as follows: Although pulse pressure is not affected significantly, systolic and diastolic pressures increase 25 to 35 per cent. when a sudden change in temperature is the stimulus. Both the respiration rate and the heart rate are decreased somewhat. Under typical basal conditions pulse and respiration rates, blood pressure and body temperature are slightly lower than normals recorded in temperate climates. Basal metabolism averages 10 to 15 per cent. lower than that reported for temperate climates. Blood sugar levels, on the other hand, are slightly above the normal limit of 120 mg per cent. Although the results presented should be extended, those now at hand indicate that an acclimatization does take place in white men when subjected to the extreme conditions prevalent in the Antarctic. It is suggested that the acclimatization process is begun by the continual pressor action of the low temperature. This primary stimulus, when repeated frequently, as is the case, induces hypo-effects in the several endocrine systems principally involved in metabolism.

The Friday evening lecture was given by Vilhjalmur Stefansson on "Military Aspects of the Arctic," and was an able and timely contribution to this important subject.

The program on Saturday morning consisted of ten papers, eight of them being from recipients of grants from the research funds of the society. The chief results of these researches are given in the following brief abstracts:

Lester W. Strock, geochemist, Saratoga Springs Laboratory. The Geochemical Genesis of Saratoga Mineral Waters and the Spectrochemical Analysis of Their Characteristic Trace Elements.

The more abundant constituents of the mineral waters occurring at Saratoga Springs, N. Y., have been traced to four geochemically distinct sources. These sources, listed in the order in which the parent ground waters obtain their materials from them, are: (1) the "Camillus" lime mud rock of the central New York Silurian formations which furnish the potassium and bromides and which has been interpreted in this work as a "bittern shale"; (2) the rock salt beds of the same Silurian formations which supply the chlorides and most of sodium; (3) older shales and limestones underlying the salt beds from which some additional sodium, all the iodides, a very small portion of the potassium, and about half the calcium is obtained; and (4) the Little Falls dolomite which furnishes the other half of the calcium and nearly all the magnesium present in the Saratoga waters. The synthesis of Saratoga mineral waters in these four distinct stages progresses as the parent ground waters move in a general eastward and later northeastward direction toward the Saratoga region from central New York. During a large portion of their course they are confined in the Little Falls dolomite, in which they are trapped in the Schenectady basin. Their further movement eastward is blocked by a buried crystalline ridge, so that they are forced upgrade toward Saratoga by the pressure of new waters from the west. Quantitative spectrochemical determinations are being made of the lesser abundant elements in Saratoga waters, and all typical rocks of the geological formations involved in the above proposed theory of their origin. The elements zirconium and tin are strongly enriched in the waters. Beryllium is enriched to a smaller extent, while manganese, cobalt and nickel are strongly depleted. Iron has been used as an empirical abundance standard and the abundance ratios for the waters compared with similar ones for the earth's silicate crust. The several thousand-fold enrichment of zirconium over titanium in Saratoga water, compared with the known ratio of these two elements in the earth's crust, is proof of the exceptional geochemical properties of these saline-bicarbonate-rich mineral waters. This discovery has served as an additional incentive to search for new geochemical processes in nature by a spectrochemical analysis of the trace elements occurring in solution in all parts of the earth's hydrosphere.

Carl G. Vinson, professor of horticulture, University of Missouri. Isolation of Crystalline Tobacco Mosaic Virus Protein Using Water Miscible Solvents.

A modified method has been developed for isolating tobacco mosaic virus from juice of diseased plants. In this method a strong acid-phosphate buffer solution is used as the precipitating agent. There is no danger of inactivating the virus due to extremes of hydrogen ion concentration. Crystalline form of many substances often is determined by the character of the dispersions medium. No true crystals of the virus of tobacco mosaic have been obtained, however, from any of a large number of organic substances, miscible with water, when used in forcing the virus out of an aqueous dispersion. Acetonyl acetone has been found superior to ether in removing the pigment associated with the virus in juice of diseased plants.

Leslie A. Chambers and Werner Henle, Johnson Foundation, University of Pennsylvania. Concentration, Isolation and Determination of the Size of the Virus of Influenza A.

The infectious agent of influenza A, as it occurs in emulsions of infected mouse lung, is associated with particles about 100 mμ in diameter. Particles of similar size, chemical composition, density, staining properties and electron-microscopic appearance are derivable from normal lung tissue. Virus contained in the extra-embryonic fluids of infected chick embryos is not associated with such large structures, but may be absorbed completely from such fluids by the particles derived from normal lung tissue. This, together with other evidence, indicates that a component of normal cells may act as carrier of a considerably smaller pathogenic agent. Concentration of the virus from extra-embryonic fluids was accomplished by precipitation with protamine. Analysis of the resulting infectious complex indicates that the virus consists largely, if not entirely, of nucleoprotein. Ultra-centrifugation at about 90,000 g for 90 minutes sedimented amost all the infective material from egg fluids. Sedimentation diagrams of the resuspended sediment showed two components to be present. One of these gave a well-defined boundary and had a sedimentation constant of 31×10^{-13} corresponding with a particle size of about 12–14 mμ and a molecular weight of about 1,000,000. Fractionation by ultra-centrifugation, followed by protein analysis and infectivity tests, indicated than the heavier, less homogeneous component (S_{20} = about $800 \pm 100 \times 10^{-13}$) consisted, almost entirely, of aggregates of the smaller units. The two sedimentable fractions were infectious in approximately equal dilutions. A minimal infectious dose contained about 10^{-16} grams and therefore consisted of less than 100 particles. A size distribution curve based on measurement of electron-micrographs of the isolated virus protein showed the particles to be essentially spherical and to have a modal diameter of about 11 mμ. This is in good agreement with the estimates based on the sedimentation constant $S_{20} = 31 \times 10^{-13}$. In view of this evidence the virus of influenza A must be regarded as one of the smallest pathogenic agents yet isolated.

Herbert Shapiro, Department of Physiology, Hahnemann Medical College, Philadelphia. The Parthenogenetic Activation of Rabbit Eggs in the Unoperated Animal.

It has been shown in earlier work that cold is an effective agent in initiating artificial parthenogenesis in rabbit ova, *in vitro*. By inducing rabbits to ovulate as the result of a course of pituitary extract injections, tubal eggs of known age could be cooled *in situ* in the anesthetized animal, under sterile surgical conditions, by circulating cold water through a metal jacket into which the tube

was inserted. This mode of treatment did in one instance lead to the birth of a normal parthenogenetic female, capable of normal reproduction, which at this writing, months later, is still living. In the present series of experiments, rabbit eggs were activated parthenogenetically in the intact animal, without operating surgically. Rabbits were made to ovulate as usual by pituitary injections. Cooling of the entire animal was effected by applying an ice pack to the doe's flank, directly over the region of the Fallopian tube, as she lay anesthetized on the table. Rectal temperature, respiration and pulse rate were recorded at regular intervals. The uterine tube, which lies just under the abdominal musculature, was very likely brought to a temperature lower than that indicated by the rectal thermometer. Body temperature (normally about 39.7° C., in the rabbit) was lowered to points varying from 33.6° C. to 18.0° C. (92.5° F. to 64.4° F.). In all experiments, perfect recovery of the animals occurred. Eggs were secured at various intervals after the experiment by flushing the Fallopian tube, and they were then fixed and sectioned for microscopic study. Artificial parthenogenetic activation was obtained in two animals, one of which contained two eggs in two cell stage, when examined 40 hours after the activating treatment, and another contained a young embryo in the early morula stage. More advanced stages in embryogenesis have not thus far been obtained.

Francis Harper, research associate, the John Bartram Association, Philadelphia. William Bartram's Status as a Naturalist.

Bartram's accuracy and even his integrity have been occasionally questioned for more than a century. Among his critics have been J. E. LeConte (in 1830), J. A. Allen, F. W. True, T. G. Pearson, A. H. Howell and Remington Kellogg. His defenders have included William Baldwin, J. E. LeConte (in 1854, making handsome amends for his earlier criticism), Sir Charles Lyell, Elliott Coues and the present writer. Most of the criticism directed against Bartram has revolved about his accounts of the Alligator and the "Painted Vulture." Recent investigations have amply vindicated him on both points. To Bartram natural history was scarcely an exact science, but a study to be interpreted with something of a poet's vision. He was thus entitled to a little poetic license and occasionally availed himself of it. Now and then he seems to have trusted a faulty memory. He was frequently inaccurate in matters of dates, distances and dimensions. He lacked a proper training in taxonomy. But these shortcomings scarcely affect the general soundness and accuracy of his observations on plants, animals and Indians. There can be no question of his fundamental integrity as a naturalist. His "Travels" provides a priceless record of American natural history in the eighteenth century.

Helen C. Palmatary, Kensington High School, Philadelphia. Recent Archeological Studies in Amazonia.

In the summer of 1941 I went to Belém, Brazil, for the purpose of studying the Marajó pottery in the Museu Goeldi, also the private collection of Dr. Carlos Estevam, director of that museum. In addition to the museum work, I made a trip to Marajó Island accompanied by Dr. Carlos Estevam, and visited two important sites there—Pacoval, an artificial island in Lago Arary, where the ancient Indians buried their dead, and Santa Brigida, an important but little known site. Dr. Estevam did some excavating at the latter site. The section of the island from which the pottery comes is flat campo land, badly flooded for more than half the year; it has neither trees suitable for building material nor stone from which implements can be made. Brief references were made to some of the problems which present themselvs in connection with an effort to partially reconstruct the ancient culture or cultures of Marajó.

Charles Grosvenor Osgood, professor emeritus of English, Princeton University. The Variorum Edition of the Works of Edmund Spenser, Especially of the Minor Poems.

The Variorum Edition of the Works of Edmund Spenser, first proposed by the late Edwin Greenlaw, of the Johns Hopkins University, and carried on since his death by Dean Frederick M. Padelford, Ray Heffner and myself, has already published six volumes containing the *Faerie Queene* with full "variorum" apparatus. The present project, for which as special editor I am responsible, is the editing of the "Minor Poems" of Spenser. These will occupy two volumes larger than any yet issued. The first of these is in press, the second largely compiled, though not fully checked and revised. The work of a "Variorum" editor is twofold: (1) the preparation of a new text embodying all the help of preceding editors and a new collation of all the early editions; (2) the assembling, appraising, sifting, arranging and condensing of all relevant comment and lucubrations, and the addition of the editor's comment where it is called for. We trust that the text of the "Minor Poems" which we have established will become the definitive text. Certainly no other edition has included the examination of so many copies of the earliest editions. I have assembled and weighed all the widely scattered material I can find which will serve to elucidate the poet's meaning and the composition of the work.

Leonard G. Rowntree, chief, U. S. Medical Division, Selective Service. The Health of Registrants and the President's Plan of Rehabilitation.

Selective Service is charged with the function of procurement of men for the Army. More than 17,000,000 men have been registered to date and more than 2,000,000 have been examined. The average height of registrants examined is 67½ inches. This figure is identical with that obtained for the Army in World War I. The average weight of registrants is 150 pounds, which is 8 pounds heavier than the average for the men examined for the Army in the last war and 14 pounds more than the average for soldiers in the civil war. Selective Service examinations reveal that great differences exist in the health in various parts of the country. A "health belt" is found in a group of western states centering around Colorado. A somewhat similar belt of good health was found to exist

during the last war. The poorest physical state is encountered in some of the southern states. The difference in health in these areas is quite marked; thus for every 10 men examined in Colorado 7 are found acceptable, whereas in one of the southern states only 3 are acceptable. The physical fitness varies greatly with age. The average age of the registrants was 25.7 years. Of those 21 years of age, more than 60 per cent. were fit, whereas those 36 years of age less than 30 per cent. were fit. The Selective Service and Army boards have rejected as unfit for military service approximately 50 per cent. of the registrants examined. About 100,000 are rejected for illiteracy; 430,000 are totally unfit for military service, and 470,000 are classified as 1-B; that is they might be fit for limited military service were they acceptable under Army standards. These figures are not to be interpreted as representing 50 per cent. invalidism of the registrants examined, or as indicative of 50 per cent. illness of the population in general. They simply represent unfitness for military service according to the standard requirements that have been set up by the Army.

These cases of rejections are listed in Table 1.

Because of the relatively poor physical state of 50 per cent. of the registrants examined and the urgent need for manpower for national defense, the President has suggested that as many as possible of those rejected be rehabilitated. It is estimated that around 200,000 have remediable defects. This work of rehabilitation has been assigned to the Selective Service System. Plans have been formulated and the work is already under way. Rehabilitation is to be carried out in the registrant's home community. Funds are to be provided for the medical and dental services necessitated in the rehabilitation program.

TABLE I

Cause	No. of cases	Percentage
Dental defects	188,000	20.9
Defective eyes	123,000	13.7
Cardiovascular diseases	96,000	10.6
Musculo-skeletal defects	61,000	6.8
Venereal diseases	57,000	6.3
Mental and nervous diseases	57,000	6.3
Hernia	56,000	6.2
Defects of ears	41,000	4.6
Defects of feet	36,000	4.0
Defective lungs, including tuberculosis	26,000	2.9
Miscellaneous	159,000	17.7
Totals	**900,000**	**100.0**

OBITUARY

RUDOLF SCHOENHEIMER, 1898–1941

RUDOLF SCHOENHEIMER was born in Berlin, where he received his early education and university training. After receiving the medical degree from the University of Berlin in 1922, he held for a year the position of resident pathologist in the Moabit Hospital of that city. There his interest was attracted by the problem of atherosclerosis and his first published works, dating from that period, relate to the production of this condition in experimental animals by the administration of cholesterol. Recognizing his need for a wider knowledge of biochemistry, he then studied for three years under Karl Thomas of Leipzig, from whose laboratory he published, early in 1926, an ingenious method for the preparation of peptides. During these years of supplementary training, Schoenheimer held a fellowship of the Rockefeller Foundation.

The next move was to the Pathological Institute of the University of Freiburg, where in 1926 he joined, as chemist, the staff of Ludwig Aschoff, who exerted a marked influence on his scientific development. Here, along with his regular duties in the investigation of pathological material, he again took up the biochemical study of the sterols. In 1927 he became the active, and in 1931 the titular, head of his division. During this period his researches related mainly to the metabolism of cholesterol and were continued in this field when, in 1930, he came to this country for a year as Douglas Smith Fellow in the Department of Surgery of the University of Chicago. After his return to Freiburg in 1931 his work, continued with the support of the Josiah Macy Jr. Foundation, was rudely interrupted by political developments within Germany in the spring of 1933. The last study completed in the Freiburg laboratory was reported in the *Journal of Biological Chemistry*; it established the important finding that in the normal mammalian organism cholesterol is continually and extensively synthesized and degraded in the tissues.

The Department of Biochemistry of Columbia University was fortunate in being able to provide facilities for Schoenheimer's subsequent researches. The first report published by him from this laboratory, recording the normal occurrence of cetyl alcohol in intestinal contents, has a peculiar significance in its bearing on his subsequent work on the intermediary metabolism of fatty acids. In collaboration with W. M. Sperry, he developed a valuable method for the precise determination of minute quantities of free and combined cholesterol and applied this technique to a comparative study of serum and plasma.

In 1934 Schoenheimer made a new contact which proved to exert a fundamental influence on the nature of his work. In order to exploit the availability of deuterium, discovered by Urey in 1932, for the development of biological research, the Rockefeller Foundation established a fund to enable chemists trained in deuterium techniques to apply their special knowledge to biochemical and allied problems. Under these

auspices David Rittenberg came from Urey's group to the laboratory in which Schoenheimer had been working for a year. From their association there developed the idea of employing a stable isotope as a label in organic compounds, destined for experiments in intermediary metabolism, which should be biochemically indistinguishable from their natural analogues. Justification for this scheme was found in the established fact that the hydrogen in organic matter displays the same isotope abundance as that in common water. Exploratory experiments soon showed that the feeding of 4,5-deuteriocoprostanone led to the presence of deuteriocoprosterol in the feces and that the ingestion of fat containing combined deuteriostearic acid was, surprisingly, followed by the rapid deposition of a large proportion of it in the body fats.

A similar effect was then observed to occur in animals the body fluids of which were enriched with heavy water; deuterio fatty acids appeared in the depot fats and reached a maximum in a strikingly short time. Conversely, with ordinary water in the body fluids, the isotopic label in the depot fats disappeared equally rapidly. This rapid interchange between components of the diet and of the tissues proved on further investigation to involve not only direct replacement of chemically identical fatty acids but rapid transformations, notably desaturation, saturation, degradation, elongation and reduction to alcohols. The only natural fatty acids which appeared not to be synthesized by the rat were the highly unsaturated acids known to be essential for health.

As soon as the stable isotope of nitrogen, N^{15}, became available, Schoenheimer and his colleagues applied it to an analogous study of protein metabolism. Amino acids synthesized from isotopic ammonia and added in small quantities to the diet of adult rats in nitrogen equilibrium were found to be rapidly and extensively incorporated in the tissue proteins. Like the fatty acids, they also gave evidence of chemical transformations; after the ingestion of isotopic amino acids or ammonia, heavy nitrogen was found in all amino acids isolated from the proteins, except lysine. Advantage was also taken of the possibility of labeling compounds with both isotopes, the ratio of which in the products isolated from tissue proteins indicated the extent to which the carbon chain of an amino acid had followed a different metabolic pathway from that of the nitrogen atom.

As a result of Schoenheimer's investigations, of which but a few examples have here been outlined, there has emerged a concept of metabolic "regeneration," wherein the central idea is the continual release and uptake of chemical substances by tissues to and from a circulating metabolic "pool." Coincident with these cyclic processes there occur among the components of the pool multitudinous chemical reactions, of which only relatively few are concerned with elimination of waste products. These general interpretations were summarized by Schoenheimer in his Harvey Lecture of 1937 and his Dunham Lectures of 1941.

Schoenheimer died by suicide, at the height of his productive career, on September 11, 1941. Few men had more reason for desiring to live; his work gave him intense satisfaction, and its increasing importance was widely recognized. He was surrounded by devoted friends; all who knew him held him in admiration and affection. He leaves his mother, a brother; his widow, Salome Glücksohn Schoenheimer, is an accomplished embryologist.

One of Schoenheimer's most striking characteristics was his ability to correlate pertinent facts from highly diversified branches of knowledge and bring them to bear upon problems under immediate consideration. He not only sought the advice of experts in fields other than his own, but freely discussed his scientific plans with his colleagues as well as his direct collaborators. He led his research group with tact, understanding and constant stimulation.

HANS T. CLARKE

DEPARTMENT OF BIOCHEMISTRY,
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

DEATHS AND MEMORIALS

DR. THOMAS HERBERT NORTON, research chemist, from 1883 to 1900 professor of chemistry at the University of Cincinnati, died on December 2 at the age of ninety years.

DR. CLYDE SHEPARD ATCHISON, since 1912 professor and head of the department of mathematics at Washington and Jefferson College, died on November 21, at the age of fifty-nine years.

DR. FREDERICK HUTTON GETMAN, director of the Hillside Laboratory at Stamford, Conn., from 1909 to 1915 associate professor of chemistry at Bryn Mawr College, died on December 2 at the age of sixty-four years.

A MEMORIAL service for the late Walter Granger under the auspices of the American Museum of Natural History and the Explorers Club of New York was held on November 25.

ACCORDING to an Associated Press dispatch the Government of Newfoundland has issued a five-cent postage stamp in honor of the late Sir Wilfred Grenfell, medical missionary, commemorating the fiftieth anniversary of the founding of the Grenfell Mission.

SCIENTIFIC EVENTS

THE SHORTAGE OF PHYSICIANS IN THE UNITED STATES

THE acute shortage of physicians in the United States, which has become critical in certain areas due to the added requirements of the Army and Navy and defense industries, is discussed in a report by the National Committee for Resettlement of Foreign Physicians, published in the *Journal* of the American Medical Association. For almost three years this committee, of which Dr. David L. Edsall is chairman and Dr. Tracy J. Putnam, vice-chairman, has been assisting qualified emigré physicians to adapt themselves to American standards and resettling them in those medically under-manned areas of the country where they can be most useful.

Fifteen hundred qualified emigré physicians are available for placement in rural districts or in hospitals which are in serious need of internes. The committee already has a record of more than twelve hundred successful placements, seven hundred in hospitals and five hundred in rural practice. Four thousand physicians have registered with the committee out of the total of fifty-five hundred foreign physicians who have come to the United States in the past eight years.

American medical authorities may well follow the plan which the British have adopted to take advantage of the services of emigré physicians. Our own needs are no less urgent. The Office of Production Management and other agencies estimate that within the next six months there will be a ten per cent. decrease in the number of physicians available for civil wants. Certain states will be more seriously affected than others. The steady shift of American physicians from rural to urban areas in the past fifteen years has resulted in a serious disproportion in the ratio of physicians to the population. Only twenty per cent. of the medical graduates of 1920 to 1925 have settled in communities of 5,000 or less, even though such communities contain nearly half the population of the country. The general proportion of physicians in cities of 100,000 or over increased from 37.9 per cent. in 1923 to 46.2 per cent. in 1931.

The committee urges that serious consideration be given immediately to the problem of speeding up the resettlement of emigré physicians. The House of Delegates of the American Medical Association has officially recommended the use of these physicians. Federal Public Health authorities have recorded similar opinions. Under the present circumstances, it would be unwise to overlook any opportunity to supply medical services to those areas which need them most.

The American Medical Association and the Public Health authorities should take up this task, in the opinion of the committee. The successful records of the men and women placed by the committee are proof of their adaptability to our national needs. Proper resettlement and the acceptance of some qualified emigrés for Army and Navy needs, the Indian Service and other public agencies will protect native Americans against permanent loss of practice, if called to military service. This will also avoid overcrowding and undue competition in many cities.

THE NATIONAL MALARIA COMMITTEE

AT the twenty-fourth annual meeting of the National Malaria Committee, held at St. Louis, Mo., from November 11 to 13, held conjointly with the Southern Medical Association, an amendment to the constitution was adopted whereby the name of the organization was changed to the National Malaria Society. Plans were developed for the publication of a periodical, to appear initially as an annual, which will be known as the *Journal* of the National Malaria Society. Publication will be in charge of an editorial board appointed for staggered three-year terms. The initial board includes Colonel Charles F. Craig, M.C., U.S.A., Ret., Dr. Justin Andrews and Nelson H. Rector. The officers elected include:

Honorary President, Dr. L. O. Howard, Washington, D. C.
President, J. H. O'Neill, New Orleans, La.
President-elect, Colonel J. S. Simmons, Washington, D. C.
Vice-president, Dr. H. W. Brown, Chapel Hill, N. C.
Secretary-Treasurer, Dr. Mark F. Boyd, P. O. Box 997, Tallahassee, Florida.

The president appointed Dr. H. C. Clark, Panama City, representative from the society to the council of the American Association for the Advancement of Science.

The unexpected death of Dr. J. N. Baker, Montgomery, Ala., the chairman, three days before the meeting, was deeply felt by all in attendance.

RESIGNATION OF DR. RAPPLEYE AS COMMISSIONER OF THE DEPARTMENT OF HOSPITALS OF THE CITY OF NEW YORK

THE following resolution has been passed by the council of the New York Academy of Medicine:

When Dr. Willard C. Rappleye agreed to assume the duties of Commissioner of the Department of Hospitals of the City of New York, it was with the understanding that it would be for a year and three months, that is, to

the end of the second term of the mayor's incumbency in office, so that he might return to his duties as Dean of the College of Physicians and Surgeons of Columbia University on January 1, 1942.

To the difficult task of Commissioner of Hospitals, Dr. Rappleye brought his recognized administrative ability, vigor, persuasive powers and a high civic spirit. These qualifications blended very well with the pattern which had been developed by his predecessor and as a result the work of the Department of Hospitals has continued on a high plane to the benefit of the sick, of medical education and of community relationships.

In view of the pending resignation of Dr. Rappleye, the New York Academy of Medicine wishes to go on record as urging him to continue as Commissioner of Hospitals, particularly in view of the exceptionally heavy responsibilities which the Department of Hospitals is to face during this period of national peril.

Copies of the resolution were addressed to President Butler, of Columbia University, and to the mayor, Fiorello La Guardia.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE American Society of Mechanical Engineers at its annual dinner on December 3 conferred five honorary memberships, which were presented by William A. Hanley, the retiring president. These were Clarence Decatur Howe, minister of munitions and supplies for Canada; Rear Admiral Samuel M. Robinson, chief of the Bureau of Ships, U. S. Navy; Major General Charles M. Wesson, chief of ordnance, U. S. Army; Leon Pratt Alford, chairman of the department of administrative engineering, New York University, and Aurel Stodola, formerly professor of mechanical engineering, Technical University, Zurich, Switzerland.

James W. Parker, vice-president in charge of engineering of the Detroit Edison Company, took office as president on December 5. He succeeds William A. Hanley as president of the society.

Four newly elected vice-presidents and three new managers of the society also took office as members of the council. The vice-presidents, who will serve until December, 1943, are Clarke F. Freeman, of Providence, R. I., senior vice-president and engineer of the Manufacturers Mutual Fire Insurance Company; Clair B. Peck, managing editor of *Railway Mechanical Engineering;* W. H. Winterrowd, vice-president in charge of operations, Baldwin Locomotive Works, Eddystone, Pa., and W. R. Woolrich, dean of the College of Engineering of the University of Texas.

The new managers, elected until December, 1944, are; William G. Christy, smoke abatement engineer of Hudson County, N. J.; Herbert L. Eggleston, manager of gas and refining departments, Gilmore Oil Company, Los Angeles, and Thomas S. McEwan, consulting management engineer of Chicago.

AWARD TO THE DOW CHEMICAL COMPANY

THE 1941 Award for Chemical Engineering Achievement was presented on December 2 at a dinner at the University Club, New York City, to the Dow Chemical Company, Midland, Mich., for its pioneering research in the recovery of metallic magnesium from sea water. The presentation was made by Colonel Alfred H. White, chairman of the award committee and head of the department of chemical and metallurgical engineering of the University of Michigan. The award is presented biennially by the McGraw-Hill magazine, *Chemical and Metallurgical Engineering,* to the company which in the opinion of the Committee of Award has contributed the most meritorious advance to the industry and profession. In presenting the award to Dr. Dow, Colonel White said:

> The company which receives this award has a wonderful record of past achievement in development of processes and also in development of men. The award is made for a very recent specific achievement, but this achievement would not have been possible without the organization built up through many years.
>
> Since 1940 this company has built on the coast of Texas a huge plant constructed primarily to extract metallic magnesium from the ocean water, but also to manufacture bromine, ethylene bromide and a number of other chemicals. This is the first plant in the world to extract metal commercially from ocean water. It is for this specific achievement that the 1940 Award for Chemical Engineering Achievement is conferred.

Dr. Willard H. Dow, president and chairman of the board of the company, accepted the bronze plaque symbolizing the award in behalf of his company. S. D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering* and president-elect of the American Institute of Chemical Engineers, acted as toastmaster and introduced the speakers. The dinner was held in connection with the eighteenth National Exposition of the Chemical Industries, at Grand Central Palace.

The award was established in 1933 and is presented biennially in recognition to group effort and accomplishment of a company rather than to an individual. Previous recipients of the award are:

> 1933, Carbide and Carbon Chemicals Corporation for the development of synthetic organic chemicals from petroleum and natural gas. 1935, Organic Chemicals Department of the du Pont Company, for the development of synthetic rubber from acetylene and synthetic camphor from American turpentine. 1937, Standard Oil Development Company for synthetic aviation fuels and related products from petroleum. 1941, the Dow Chemical

Company for the development of a successful process for recovering metallic magnesium from ocean water—the first metal to be obtained in commercial quantities from the ocean in the history of the world.

AWARDS OF THE CHARLES FREDERICK CHANDLER MEDAL

AWARDS of the Charles Frederick Chandler Medal of Columbia University have been made to two brothers, Dr. Robert R. Williams, chemical director of the Bell Telephone Laboratories of New York, and Professor Roger J. Williams, of the University of Texas.

Dr. Robert R. Williams was cited for "his years of work on the isolation of Vitamin B_1 and his contributions to the elucidation of its chemical structure." Vitamin B_1, which he synthesized and named thiamin, is the antineuritic beriberi vitamin, vital to nerve health and life.

The award to Professor Roger J. Williams was made in recognition of his discovery of pantothenic acid, powerful regulator of growth popularly known as "the acid of life" and for his contributions to the knowledge of the Vitamin B complex.

This is the first double award of the medal since it was established in 1910 in honor of Dr. Charles Frederick Chandler, professor of chemistry at Columbia University, pioneer in industrial chemistry. The formal presentation will take place in February at a ceremony in Havemeyer Hall, at which each of the 1942 recipients will receive a medal and each will deliver a lecture.

Dr. Robert R. Williams, in addition to his work on Vitamin B_1, has contributed to industrial chemistry through his leadership of an organization of 140 workers in the Bell Telephone Laboratories, of which he has been chemical director for the last seventeen years.

Pantothenic acid, for the discovery of which Dr. Roger J. Williams received the award, is one of the most important components of the vague "bios" of the period twenty years earlier. It represents the first example of a compound whose structure has been elucidated in spite of the fact that its isolation in pure form has so far not been possible.

In investigating bios Dr. Williams, working with the purest material he could obtain, devised new modes of characterization of the substance in terms of physicochemical and physiological properties which furnished the clues for the later verification of its structure by synthesis at the Merck Laboratories with his collaboration. This work led to the exploration of many other plant growth stimulants to which he gave the name "nutrilites."

Professor Arthur W. Thomas was chairman of the Chandler Award Committee. Other members were Professors Leo H. Baekeland and Arthur W. Hixson. There have been seventeen previous recipients of the medal. The last award was made in 1939 to Thomas H. Chilton, director of the technical division of the engineering department of E. I. du Pont de Nemours and Company at Wilmington.

SCIENTIFIC NOTES AND NEWS

THE John Fritz Medal for 1942 has been awarded to Dr. Everette Lee DeGolyer, consulting petroleum engineer, of Dallas, Texas, and president of the Felmont Corporation, in recognition of his work on the application of geophysical exploration to the search for oil fields. The award, which is sponsored by the four leading national engineering societies, will be presented to Dr. DeGolyer at a dinner of the American Institute of Mining and Metallurgical Engineers at the Waldorf-Astoria Hotel, New York City, on January 14.

DR. TOM DOUGLAS SPIES, of the School of Medicine of the University of Cincinnati and Hillman Hospital, Birmingham, Ala., in recognition of his work with nicotinic acid, was presented at a meeting on December 8 in Washington with the Award of Distinction of the American Pharmaceutical Manufacturers' Association. This award is made annually to an investigator who, in the opinion of the committee, has made a fundamental contribution to public health in the field of drug therapy. Last year Dr. Perrin Long, of the Johns Hopkins School of Medicine, received the award for his study of the use of the sulfa drugs.

THE Lister Medal for 1942, which is given in recognition of distinguished contributions to surgical science, has been awarded to Dr. Evarts A. Graham, professor of surgery in Washington University, and he will deliver the Lister Memorial Lectures in 1942, or later, under the auspices of the Royal College of Surgeons of England.

THE council of the Royal Horticultural Society, London, has made the following awards for the year 1941: Victoria Medal of Honor.—E. L. Hillier, for his work in the introduction of new and rare plants. Associateship of Honor.—W. D. Besant, director of parks and botanic gardens, Glasgow; G. F. Hallett, head gardener at Lilford Hall, Oundle, Peterborough; F. Streeter, head gardener at Petworth Park, Sussex; H. Windibank, head gardener at Frensham Hall, Haslemere. Veitch Memorial Medals and Prizes.—B. Y. Morrison, Washington, D. C., gold medal for

his work for horticulture both in America and in England; R. F. Wilson, gold medal for his work in connection with the horticultural color chart; Mrs. Malby, silver medal and £25 for her photographic work on garden subjects. Loder Rhododendron Cup. —Dr. J. Macqueen Cowan, for his work on the botany of the rhododendron.

A NEW wing of the Barros Luco Hospital at Santiago, Chile, has been named for Dr. Joseph Francis McCarthy, professor of urology at Columbia University and director of the department of urology of New York Polyclinic Medical School and Hospital.

DR. ERNEST ESCLANGON, professor of astronomy at the University of Paris, director of the Paris and Meudon Observatories, has been elected president of the French Academy of Sciences for 1942.

DR. ROY YOUNG has been elected president of the Royal Faculty of Physicians and Surgeons at Glasgow.

AT the annual meeting at St. Louis on December 4 of the American Society of Refrigerating Engineers, Dr. William R. Hainsworth, of New York, vice-president in charge of engineering of Servel, Inc., who has been engaged for more than twenty years in research on the problem of refrigeration, was elected president. He succeeds L. L. Lewis, vice-president of the Carrier Corporation, Syracuse, N. Y.

AT the second annual meeting of the Nevada Academy of Natural Sciences, held on November 19 at the University of Nevada, Ira La Rivers, of Reno, was reelected president, J. R. Alcorn, of Fallon, was elected vice-president, and Dr. Harry E. Wheeler was elected secretary-treasurer. Dr. Philip A. Lehenbauer, Dr. W. D. Billings, Dr. Frank Richardson, Dr. E. W. Lowrance, all of Reno, were elected members of the executive committee.

DR. JAMES H. MCGREGOR, since 1924 professor of zoology at Columbia University, who has been associated with the faculty since 1897, when he was appointed assistant in zoology, will retire next year. The Pre-Medical Society of the university is giving a testimonial banquet in his honor on December 12.

DR. JOHN BEATTIE, conservator of the museum and director of research of the Royal College of Surgeons of England, has been appointed Bernhard Baron research professor of the college.

DR. HIRAM A. JONES, director of health and physical education for the State of New York at Albany, has been elected chairman of school and of the college coordinators for the national health program.

DR. JULIUS SENDROY, JR., of the department of experimental medicine of Loyola University School of Medicine, has accepted an assignment under the National Research Defense Committee.

DR. C. STACY FRENCH, research instructor in chemistry at the University of Chicago, has been appointed assistant professor in the department of botany of the University of Minnesota.

DR. ROBERT A. MILLER, director of libraries at the University of Nebraska since 1937, has been made director of libraries at Indiana University. He will take up this work on March 1.

PROFESSOR CHARLES G. KING, of the University of Pittsburgh, and Dr. H. E. Longenecker, Buhl Foundation research fellow and assistant professor of chemistry at the university, will direct a study on the nature of fats and oils under the first of the fellowships in nutrition recently offered by Swift and Company, Chicago, of which Dr. R. C. Newton is vice-president in charge of research. Dr. Karl F. Mattil, of the Pennsylvania State College, has been appointed research fellow under the Swift grant. He will study the nutritive properties of foods and their application to the improvement of American diet and health.

DR. RAY TREICHLER has been appointed by the U. S. Fish and Wildlife Service to take charge of the recently established biochemical unit in the Food Habits Laboratory at the Patuxent Research Refuge at Bowie, Md. He will be engaged chiefly in chemical and nutritional investigations of the natural foods of wildlife and in biochemical studies of animals in the laboratory to determine the effects of different diets.

DR. JULIAN HUXLEY, secretary of the Zoological Society of London, has arrived in New York after traveling to Canada from England in a convoy. He will lecture on war-time changes in Great Britain.

DR. C. H. KELLAWAY, director of the John and Eliza Hall Institute, Melbourne, Australia, is visiting the United States.

PROFESSOR JOE WEBB PEOPLES, of the department of geology of Wesleyan University, is spending part of a sabbatical year at Northwestern University. In collaboration with Professor A. L. Howland he is at work on a government report.

THE Rockefeller Foundation has made a grant of £1,000 to the University of Oxford towards the cost during 1942 of research on the growth of and regeneration of nerves to be undertaken by Dr. J. Z. Young in the department of zoology and comparative anatomy.

DR. WALDEMAR KAEMPFFERT, science editor of *The New York Times*, gave on December 11 the first of a series of lectures and demonstrations on modern developments in industry, under the auspices of the

department of vocational education of the New York University School of Education. He spoke on "The Contribution of Science to Industrial Development."

DR. ARNO B. LUCKHARDT, professor of physiology at the School of Medicine of the University of Chicago, lectured under the auspices of the Robert Sonnenschein Study Group for Medical History at the Michael Reese Hospital on December 10 on "Dr. William Beaumont and the Medical Epic of the Northwest Territory."

DR. ROBERT F. LOEB, professor of medicine at the College of Physicians and Surgeons, Columbia University, will deliver on December 18 the third Harvey Society Lecture of the current series at the New York Academy of Medicine. He will speak on "The Adrenal Cortex and Electrolyte Behavior."

DR. FREDERICK A. COLLER, professor and director of the department of surgery at the University of Michigan Hospital, will give the ninth E. Starr Judd Lecture at the University of Minnesota on January 21. He will review "Studies on Water and Electrolyte Balance in Surgical Patients." Dr. E. Starr Judd, an alumnus of the Medical School of the University of Minnesota, established this annual lectureship in surgery a few years before his death.

POSITIONS paying $4,600 a year in the Bureau of Plant Industry of the Department of Agriculture will be filled from a civil-service examination for floriculturists, olericulturists and plant pathologists. A written test will not be given, but applicants will be rated on their education and experience. These are "research" positions involving the supervision of assistants and the preparation of manuscripts for publication as well as the handling of technical correspondence. Applicants must have completed a 4-year college course with major study in biological science, and must have had responsible research experience, although for part of this experience certain graduate study may be utilized. Those interested in these positions are urged to look upon them as the beginning of a career in the government service. Applications must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than January 3, 1942.

THE Bloede Scholarship of the Chemists' Club is available for the year 1942–43. Applications will be received beginning on January 1 and closing on March 1. This scholarship is awarded in alternate years and provides a stipend of $580, payable in semi-annual instalments. Candidates are limited to men entering their last year of post-graduate work leading to the Ph.D. degree in chemistry or chemical engineering in an institution of recognized standing. Application blanks may be obtained after January 1 from the Secretary, the Chemists' Club, 52 East 41st Street, New York, N. Y.

THE annual meeting of the History of Science Society will be held at Chicago in conjunction with the American Historical Association on December 30 and 31.

BECAUSE of the large amount of work being done by the National Academy of Sciences and National Research Council committees in an advisory capacity to the government during the present emergency, and because exhibit and other rooms formerly open to the public are now occupied as offices, the Council of the National Academy of Sciences has directed that the National Academy of Sciences Building be closed to the public until further notice. The National Academy of Sciences regrets that this step is necessary, but will, as soon as circumstances permit, reinstall exhibits of scientific interest to the public. The 1942 annual meeting of the academy will be held in the academy building as usual (April 27, 28, 29); but attendance at the scientific sessions will be limited to academy members, their invited guests, the press and to non-members who present papers before the academy. Hitherto these sessions have been open to the general public. It is regretted that programs, as well as abstracts of the papers, will be available only to members of the academy and to the press.

WITH a view toward serving not only the needs of the present emergency, but also those of future reconstruction and development, it is now planned to integrate the activities of the past few years at New York University by establishing an Institute for Applied Mathematics.

THE Kansas City-Western Dental College has been merged with the University of Kansas City. Dean Roy J. Rinehart will continue as administrative head and will also serve on the advisory council of the University Board of Trustees.

AN Associated Press dispatch reports that the Vichy Government has announced the establishment of the Alexis Carrel Foundation for Study of Human Problems, under the direction of Dr. Carrel. Dr. Carrel went to France on March 15 to make a study of the physical effects of blockade conditions and malnutrition, and has since been living in the occupied zone.

THE organization of a research foundation by the Alumni Association of the University of Washington to aid in scientific investigation and in the application of the results of research in the development of the state has been approved by the Board of Regents of the university. The organization, which will be

incorporated as an independent and non-profit foundation, will be a corporation working in close harmony with the university but managed by a board of eleven trustees. Under the incorporation the foundation will be able to receive all types of bequests, gifts, assignments of patents, royalties, etc. It will be a business corporation so far as contracts, trust agreements, licenses and buying and selling are concerned.

The News Edition of the American Chemical Society states that the National Aniline and Chemical Company, a subsidiary of Allied Chemical and Dye Corporation, New York, is being merged with the parent company. Its business will be conducted as the National Aniline and Chemical Division of the Allied Chemical and Dye Corporation. B. A. Ludwig, president of National Aniline, and E. W. Clark, president of the Barrett Company, another subsidiary, have been appointed vice-presidents of Allied Chemical and Dye Corporation.

THE RCA electron microscope has been adjudged the winner in a Products Design contest entered by hundreds of American manufacturers which was conducted by *Electrical Manufacturing* on the grounds of its basic design and its outstanding external appearance, and a descriptive "Award Paper" prepared by Theodore A. Smith, of the RCA Engineering Products Division.

IT is reported in *The British Medical Journal* that at the suggestion of Dr. G. Jedlewski, medical adviser to M. Raczkiewicz, the Polish President, a special medical board has been formed in London to prepare plans for fighting epidemics which may break out in Poland at the end of the war, and thus to prevent the spread of infectious disease to Western Europe and Great Britain. The board, acting in conjunction with the Ministry of Health, will also collect medical supplies so that immediate help may be ready at the end of the war.

A UNITED PRESS dispatch from Berlin dated December 3 reads: "Reports from Berlin said that the University of Brussels had begun a sit-down strike against German occupation authorities and that the Germans had served an ultimatum ordering the faculty to reopen the school to-morrow 'or take the consequences.' The trouble, according to the *Brusseler Zeitung*, began when the Germans ordered eighteen Flemish professors put on the staff, which had been entirely French. University authorities objected to three of the Germans' candidates, one of whom the newspaper described as 'a Flemish activist in the World War period.' The other two were said to be strongly pro-German."

IT is stated in *The New York Times* that filming of a documentary motion picture on nutrition has been started in Hollywood under the sponsorship of Paul V. McNutt, Federal Security Administrator. The film is a project of the Office of Defense Health and Welfare Services and is being produced by the American Film Center which is supported by the Rockefeller Foundation.

A GRANT of $50,000 has been made by the Commonwealth Fund to the American Bureau for Medical Aid to China, for the support of the Emergency Medical Service Training School in Kweiyang, China.

DISCUSSION

THE ROLE OF THE BURROWING OWL AND THE STICKTIGHT FLEA IN THE SPREAD OF PLAGUE

DURING the spring and summer of 1941 a study was made of a plague epizootic then in progress among the ground squirrels (*Citellus beecheyi*) to the east and south of Bakersfield, Kern County, California. Proof of the identity of the disease was obtained by the isolation of *Pasteurella pestis* from the tissues of infected squirrels as well as from various species of flea found on the rodent hosts. From an epidemiological point of view the possible methods of spread of the disease are of particular interest, and in this connection the following sequence of facts is considered worthy of special notice.

(1) In this epizootic, which was discovered by a survey crew of the California State Department of Public Health, the first squirrel to be proven plague-infected was obtained on April 29, 1941, on the El Tejon ranch, at a spot about twelve miles due east of Wheeler Ridge. The outbreak was evidently nearing the close of its active phase in this area, for no infected animals were found here after May 1, but the infection appeared to linger on in the flea population, for fleas obtained from squirrels as late as May 15 still had living plague organisms in their digestive tracts.

(2) Among the fleas collected from ground squirrels in near-by areas were specimens of the sticktight flea (*Echidnophaga gallinacea*), a species of extremely wide geographical and hostal occurrence in the United States. It is found abundantly on chickens and other domestic fowl, on rats and various wild rodents, and on such predators as the coyote, Cooper's hawk and burrowing owl.[1, 2] The last-men-

[1] I. Fox, "Fleas of Eastern United States," Iowa State College Press, Ames, Iowa, 11–12, 1940.

tioned of these hosts, the burrowing owl (*Speotyto cunicularia*), was seen frequently at low altitudes in areas where the plague epizootic was in force. The association of burrowing owls with colonies of ground squirrels is a well-known fact, and the obvious possibilities of contact between them need hardly be mentioned.

(3) On June 28, 1941, a specimen of the burrowing owl taken on the El Tejon ranch about five miles west of the plague area yielded 70 individuals of *E. gallinacea,* which upon mass-inoculation into a test guinea pig proved to be infected with plague organisms. A post-mortem examination of the owl could not be made at the time, but the possibility that this bird was the source of infection for these particular fleas seems remote, as it is generally agreed that birds are not susceptible to plague. This is apparently the first record of a bird host as a carrier of plague-infected parasites, and the first demonstration of natural plague infection in this species of flea. Experiments are now in progress to determine the vector efficiency[3] of this flea.

As long ago as 1909 Rucker[4] suggested that the burrowing owl might play an important part in the dissemination of plague as a carrier of infected fleas, but his remarks were not supported by any direct evidence. More recently Jellison[5] has discussed the rôle of predatory birds in the spread of plague and has shown that rodent fleas of various species are frequently transported on freshly killed hosts to the nests; however, in no instance was the presence of plague established. The fact that plague has now been isolated from a species of flea common to both rodent and bird hosts, and from specimens actually obtained from a bird, finally lends supportive evidence to an old theory and adds another complicating factor to the epidemiology of plague.

C. M. WHEELER
J. R. DOUGLAS
F. C. EVANS

GEORGE WILLIAMS HOOPER FOUNDATION,
UNIVERSITY OF CALIFORNIA,
SAN FRANCISCO

THE TERM "EUTHENICS"

WHEN the charter for the establishment of the Iowa Child Welfare Research Station was prepared, I was in favor of using the term "euthenics," defined in Webster's dictionary as "the science having to do with the betterment of living conditions to secure more efficient human beings," as a term coordinate with the term "eugenics." In common language, eugenics would then denote the science and art of being well born, and euthenics the science and art of living well or wise living. This would have been very appropriate, but at that time we had to win the popular approval of the legislature and the people of the state so we fell back on the easily understood term "child welfare" and gave it a new connotation by centering it upon scientific research. Now that child welfare or child development is a well-established movement, both theoretical and practical, I would again advocate the use of the single technical word euthenics to denote scientific procedures within this great area.

We may speak appropriately of the science of euthenics or the art of euthenics depending upon the point of view. In the former case, the question arises as to whether there is or can be such a science of well-being. We immediately recognize that practically all the sciences contribute to this subject, as in medicine, engineering, economics, psychology, physiology, sociology and education. The question then arises: Can the salient interests and contributions from each of the sciences be selected and coordinated into a specific applied science? Likewise we may ask: Can we recognize a definable and significant area to be designated as the art of well-being? It is well recognized that such applied arts as education, sociology and mental and physical, individual and social hygiene center about this issue. The question then arises: Can the salient interests and contributions from all such sources be selected and coordinated into a specific applied art? On both of these issues, the time would now seem ripe to recognize an affirmative answer.

In other fields the term "psychology" is made to function, as in the psychology of music, the psychology of art, the psychology of speech, the psychology of dramatics, the psychology of athletics or the psychology of advertising. This terminology is justified on the ground that it is the function of psychology as a science of experience and behavior to select, integrate, organize and foster interests developed in all other sciences pertaining to the subject and to take the initiative for the conduct of research within these specific fields of applied science. The term "psychology of music" has the advantage of having made the best contacts with musical education and other musical enterprises. Within one year four textbooks under the same title, "The Psychology of Music" were published. That term has gained full recognition as a coordinator of all the scientific approaches to the

---

[2] M. A. Stewart, *Jour. Econ. Entom.*, 25: 165, 1932.
[3] C. M. Wheeler and J. R. Douglas, *Proceedings, Soc. Exp. Biol. and Med.*, 47: 65–66, 1941.
[4] W. C. Rucker, *U. S. Public Health Reports*, 24: 1225–1238, 1909.
[5] W. L. Jellison, *U. S. Public Health Reports*, 54: 792–798, 1939.

theory and practice of music. On this analogy we might speak of the psychology of child welfare or the psychology of child development. But this would hardly be appropriate in view of the large number of strong independent trends in other sciences within this field.

There is still another analogy which is illustrated by the term "musicology," which is now coming into use to designate all scientific approaches to the science of music. It already claims a number of distinct fields, such as the history of music, the theory of music, musical anthropology, the science of composition, phonetics and acoustics. Can euthenics be thus recognized as a comprehensive term within which a number of specific areas may function?

The term "eugenics" is now well established for both scientific and practical purposes as the science of being well born. This is a happy term and defines adequately one specific area in the immensely larger field of genetics. It is generally restricted to this one aspect of human genetics. It would be well if we could establish a term which would be an exact companion piece to denote the area of the development of well-being. The term "euthenics" seems to meet all the requirements for this.

Within the area of eugenics we recognize various segments; such as individual eugenics and racial eugenics, and various areas pertaining to controlling factors; such as eugenic birth control, eugenic climate and eugenic legislation: so in euthenics we might recognize logical divisions, such as child euthenics, adult euthenics and racial euthenics; and various areas pertaining to causal factors, such as medical euthenics, ethical euthenics and legislative euthenics. For all such purposes such terms as child welfare and child well-being would seem to be partial, inadequate and cumbersome.

As we make satisfactory distinctions between theoretical, experimental and practical eugenics, so we might to great advantage distinguish between theoretical, experimental and practical euthenics. A relatively new term such as this is something of a red rag because it is new. But like the child who takes pleasure in pronouncing long words, the educated public would soon recognize the appropriateness of the derivation of this word and quickly give it a place in the language of daily life to designate a field of universal human interest.

The adoption of this technical term would not discourage the continued use of such terms as child guidance, child welfare and child development, but would tend to give each such term a more specific connotation.

As in eugenics a person who is devoted to that science is spoken of as a *eugenist,* it would be convenient to have in the field of euthenics the provisional designation *euthenist.* We would hardly think of calling such a person a child developer. The listing of eugenics in the university catalogue might have some advantage over the present practices without any sacrifice of present interests. It would be advantageous to have such a technical term in the various rosters of the sciences.

As indicated above, the moment for the establishment of the mother institution of child welfare research stations was not a propitious moment for reinforcing the term "euthenics," but may it not be that the present time is the psychological moment to clarify the issue in the light of the extraordinarily rich experience gained within this field in the last twenty-five years? Scientists can look at the situation in an entirely different light now than they could before that movement began to crystallize.

And may we not also find it useful to distinguish between the science of euthenics and the art of euthenics? Each of these two distinct points of view is now clearly on the horizon as a fascinating, mandatory and profitable field of research which may be well centered and clarified in the interest of the theory and practice of wise living.

CARL E. SEASHORE
THE STATE UNIVERSITY OF IOWA

ONE UNUSUAL OBSERVATION IN THE AURORAL DISPLAY OF SEPTEMBER 18

RECENTLY in discussing the auroral display of September 18 last with Dr. Harlan T. Stetson, I called attention to the amazing nearness of the overhead streamers at one time. Dr. Stetson explained that such an observation was not likely to be accepted, perhaps because of the nature and method of production of the streamers.

I am therefore making this belated record of certain of my observations on September 18. The observations were made near and about Bexley Hall, 50 Massachusetts Avenue, Cambridge.

The streamers were first observed somewhat after 8 P.M. At this time there were two quiet streamers in the north slightly to the west. These seemed to connect near the zenith with a searchlight beam emanating in Boston. Shortly the streamers began to cut capers, first by blinking on and off. From then until near midnight several distinct phenomena were seen. (I will not discuss the curtain of colored light which appeared so beautifully twice above the northern horizon, because there is nothing unusual to report, and in attempting such might disclose disqualification for reporting on the apparent nearness of the streamers at one time.)

Some of the general observations are as follows:

The number of the streamers varied in number from one to four, and usually terminated near the zenith. Sometimes they would pop on or off suddenly. Other times they would change from one state to another very slowly. Sometimes they would be blinking like stationary waves. Many times they appeared as moving waves of light, going from north toward the zenith. At irregular intervals the apparent distance of the streamers varied. They always appeared near in comparison with the northern curtain. The maximum distance never seemed more than forty miles, and several times seemed closer than cumulus clouds. The one observation that has stood out was made a little after 10 P.M. The one mass streamer seemed to be only twenty or thirty feet above my head. It was moving as waves in the general direction of Massachusetts Avenue toward Boston. It reminded me of fine particles of snow moving in a severe wind, as in a blizzard, when the snow is illuminated by a beam of light. The waves seemed to have much depth, as do the waves of moving snow in a blizzard. Nothing was visible beyond.

C. J. Taylor, of the Radiation Laboratory, Massachusetts Institute of Technology, made substantially the same observations from the roof of the Massachusetts Institute of Technology. While he was some fifty feet higher, the moving streamers were about the same distance above his head as they were above mine.

S. F. West reports that he observed the moving streamers or moving flashes of light to be barely over his head at about 10:30 on that evening. His observations were made on the roof of the Massachusetts Institute of Technology. It should be added that throughout the evening and night a very destructive fire was burning at Charlestown about two miles away. It is barely possible that the wind may have carried ionized air over our observation posts for a short interval. In general, however, the direction of the wind was toward Boston.

F. C. BROWN

QUOTATIONS

CHEMISTS AND THE NATIONAL DEFENSE

IN recent months many members of the American Chemical Society have expressed a desire to take an active part in the program of national defense. The number of letters which have been received by various officials in Washington from chemists all over the country offering their services to the Government is a clear manifestation of the great desire of the members of our profession to do their part in the present gigantic task of rearmament. Unfortunately, in many cases it has not been possible to take advantage of the talent thus offered. This is a physicist's war rather than a chemist's. For the present, at least, there appear to be more investigations of a physical nature than there are chemical military problems. But the situation may at any moment change rapidly. It is well to have a reservoir of research capacity in our colleges, universities, consulting laboratories and research institutes. It may not be long before this reservoir will be heavily drawn upon for tasks directly concerned with defense problems. And in the meantime it is of vital importance to the nation that our educational institutions continue to train young chemists and chemical engineers. Chemists in industry are, of course, engaged in work which almost without exception is in one way or another an integral part of the total defense activities of the country. More young men will be required every month for these tasks. Every teacher of chemistry, whether or not he is carrying on research for the Government, is playing an important part in the rearmament program of the nation.

Although physicists and electrical engineers rather than chemists are concerned with the most pressing research and development problems of the Army and the Navy, this does not mean there is no chemical work in progress. Quite the contrary. Both the Army and the Navy for years have maintained chemical laboratories where investigations are conducted on explosives, chemical warfare and a multitude of miscellaneous problems. In this period of unlimited national emergency, the work of these governmental laboratories must needs be supplemented. And to this end a number of chemists in universities and industrial laboratories have been called upon to assist. To some extent this has been done directly by the services, but to a large measure the task of assisting the scientific personnel of the armed forces has been the responsibility of the National Defense Research Committee. The effort has been to distribute the work as far as possible to a good many different laboratories and to draw on all branches of our profession. More than half the starred chemists in "American Men of Science" are now involved in one way or another in work pertaining directly to the national defense program.

The NDRC was created by presidential order in June, 1940. It came into being at a time when the shock of the fall of France had galvanized this country into action. The need for haste in the rearmament program was apparent to all. Industry was being called upon to perform miracles of speedy readjustment and expansion. A mobilization of scientific talent was evidently also a first order of the day. What was clearly needed was not another advisory

body, for the National Research Council was already functioning admirably in this respect, but an executive agency to assist the Army and the Navy by organizing the scientific reserve power of the country and putting it to work on those problems deemed most vital by the members of the armed forces. To this end, the committee was supplied with funds and given authority to enter into contracts with research institutions, both academic and commercial, for the prosecution of research under suitable conditions of secrecy.

Vannevar Bush, president of the Carnegie Institution of Washington, was appointed chairman. The Secretary of War and the Secretary of the Navy were each represented on the committee by high-ranking officers. In addition, many other officers were designated for liaison purposes on special problems. Through these channels we soon discovered in broad outline the nature of the most urgent matters that required scientific investigation. The civilian members of the committee divided up the work. To my lot fell chemistry; to President Compton of M. I. T. was assigned one branch of physics; to Frank B. Jewett, another; to Richard C. Tolman, of California Institute of Technology, a third aspect of physical investigation. Each of these divisions soon organized sections or subcommittees, each dealing with special problems.

My first act as chairman of the Chemical Division was to have Roger Adams and W. K. Lewis appointed vice-chairmen to organize two separate phases of the work. Needless to say, elaborate precautions were necessary to ensure secrecy. We were asked to sit down as partners with the scientists and engineers of the Army and the Navy and to share their secrets. Therefore, we saw to it that in every way we were as careful with our confidential information as the armed services themselves.

Unfortunately, the very secrecy to which I have just referred prevents my making this brief article interesting. Instead of listing the extremely interesting and highly important problems we have been called upon to solve, a writer on this subject must have recourse to dull statistics. During the first year of its existence, the National Defense Research Committee spent approximately $10,000,000 through 270 contracts placed in 47 different universities, technical schools and research laboratories; and 153 contracts placed with 39 industrial firms. Nearly 2,000 scientists are at work under these contracts and approximately the same number of technicians and assistants.

Last June an Executive Order created the Office of Scientific Research and Development with Vannevar Bush as director. In his new capacity Dr. Bush was charged not only with many of his former responsibilities as chairman of NDRC but with the further task of coordinating research on medical problems affecting national defense. And most important of all, he has charge of coordinating and, where desirable, supplementing the scientific research activities for defense carried on by the Departments of War and Navy and other agencies of the Federal Government. The NDRC now becomes a part of the new Office of Scientific Research and Development and I, as the new chairman, am responsible to Dr. Bush. Roger Adams has become a member of the NDRC and is in charge of all the work of the chemists.

A new Medical Research Committee of which A. N. Richards is chairman has been formed. The other members of this committee are L. H. Weed, A. R. Dochez, A. B. Hastings and representatives of the Surgeon General of the Army, of the Navy and of Public Health. Irvin Stewart is Executive Secretary of this committee, as well as of the NDRC and of the OSRD. This committee, which parallels the NDRC, is concerned with problems of medical research. On a scientific advisory council to the Director of the Office of Scientific Research and Development sits the chairman of this committee, the chairman of the NDRC, the chairman of the National Advisory Committee on Aeronautics and the coordinators of research of the Army and Navy. The Office of Scientific Research and Development maintains close connections with the National Research Council and its many sections and committees.

Since the work of the NDRC is concerned solely with research and development on instrumentalities of war, there are many chemical problems of national importance which lie outside its province. Some of these are clearly within the field of operation of the new Medical Research Committee, while others are the concern of the National Research Council and its agencies.

Many chemists have been asked to cooperate in the national defense program through the Chemistry Section of the council, and especially in the field of biochemistry through the Medical Research Committee and the committees of the council with which its work is closely associated. Undoubtedly there will be an expansion in this direction as well as in the work of the Chemical Division of the NDRC and gradually a still greater number of research chemists will be asked to play a part in the ever-increasing national defense effort. To those who have given freely of their time and talents, the country owes a debt of gratitude.—*James B. Conant, president of Harvard University, chairman of the National Defense Research Committee, in the News Edition of the American Chemical Society.*

SCIENTIFIC BOOKS

INDUSTRIAL POISONS

Analytical Chemistry of Industrial Poisons, Hazards, and Solvents. By M. B. JACOBS. New York: Interscience Publishers, Incorporated, 1941. Price, $7.00.

THE tremendous increase in defense production, which includes all types of industrial work, makes the appearance of this type of book a timely one. Few works to date have compiled such chemical studies. Its completeness makes it of great value for the increasing number of medical men, toxicologists, industrial hygienists and chemists coming into contact with these problems.

The contents of the book are quite thoroughly covered by references, some 1,200 in all. The table of contents and subject and author indexes make it possible to locate subject matter quickly.

The appendix, giving a tabular estimation of parts per million and milligrams per liter from molecular weights, is of special value. It also lists limits of inflammability and explosive ranges of industrial compounds; acute physiological responses to gases and vapors; probable safe concentration limits of exposure for vapors, gases, dusts, fumes and smokes according to various codes; minimum lethal doses for a number of lacrymators, lung irritants, vesicants, other war gases, etc.

Analytical methods or reference to methods for the various known compounds used or produced in industry are outlined. In addition to giving chemical methods, sampling equipment and procedures, and gas volume and velocity measurements are described.

The book gives a brief, but very helpful, pharmacological and toxicological consideration of the various compounds.

The book is well written and has a minimum of typographical errors. It is the reviewer's opinion that the price of the book, unfortunately, makes it somewhat prohibitive for the body of individuals who could reap most benefit from its use.

RALPH W. MCKEE

SCHOOL OF PUBLIC HEALTH,
HARVARD UNIVERSITY

ALGEBRA

Algebra. By W. L. FERRAR. vi + 202 pp. Oxford: Clarendon Press. 1941.

THIS book was written to provide a text, principally for university undergraduates, on determinants, matrices and algebraic forms. The only prerequisite training required is that provided by the usual course in college algebra, and thus the author's Part I consists of a 59-page presentation of the classical theory of determinants. Part II, on the theory of matrices of complex numbers, presents in 52 pages the elementary matrix concepts, the notions of characteristic function and latent root, the definitions of elementary transformations over a number field F, and the theory of equivalence of rectangular matrices over F. The final part consists of 49 pages on real quadratic forms and 30 pages on invariants and covariants. The omission of the theory of similarity of square matrices is rather curious in a text presenting the theory of equivalence of *pairs* of real quadratic forms.

The author's sources include no modern treatment of his subject, and this probably accounts for his use of so much obsolete terminology. He states that his omission of any hint of abstract algebra is deliberate, but misses the point that even an elementary exposition of the theory of matrices with complex elements could profit by the adoption of the streamlining of the modern versions.

A. A. ALBERT

THE UNIVERSITY OF CHICAGO

SOCIETIES AND MEETINGS

THE INDIANA ACADEMY OF SCIENCE

THE fifty-seventh annual meeting of the Indiana Academy of Science was held at DePauw University, Greencastle, Indiana, on October 30 and 31 and November 1. Over five hundred scientists from Indiana and Ohio were in attendance, including sixteen past presidents of the academy. The executive committee met on Thursday evening, after which President Paul Weatherwax, Indiana University, made a radio broadcast on "The History and Objectives of the Indiana Academy of Science." The general sessions opened on Friday morning with an address of welcome by President Clyde E. Wildman, of DePauw University, which was followed by a response by President Weatherwax. After a short business session a brief memorial service was held for the eleven members of the academy who had died since the last meeting. Among these eleven were William Albert Noyes, Frank M. Andrews, Charles B. Jordan, Arthur E. Haas, Clinton A. Ludwig and James Troop. The principal addresses of the general session were given by Arthur L. Foley, Indiana University, on "Why? What? Whither?" and Arthur T. Evans, Miami University, on "Some Thoughts on Origin and Evolution."

Friday afternoon was devoted to division meetings, at which about eighty papers were read and discussed. Also the new Psychological Laboratory of DePauw University was dedicated with an address by Archie G. Bills, of the University of Cincinnati.

The annual dinner was held on Friday evening with one hundred fifty in attendance after which the president's address was given by Paul Weatherwax, Indiana University, on "The Indian as a Corn Breeder." The following officers were then chosen for the coming year: *President,* M. G. Mellon, Purdue University; *Vice-president,* Theodore Just, Notre Dame University; *Secretary,* Winona H. Welch, DePauw University; *Treasurer,* William P. Morgan, Indiana Central College; *Editor of the Proceedings,* P. D. Edwards, Ball State Teachers College; *Press Secretary,* C. M. Palmer, Butler University; *Member of Research Grant Committee,* A. L. Foley, Indiana University; *Division Chairmen:* Archeology, C. F. Voegelin, Indiana University; Bacteriology, L. S. McClung, Indiana University; Botany, Ray C. Friesner, Butler University; Chemistry, K. N. Campbell, Notre Dame University; Geology and Geography, G. T. Wickwire, Hanover College; Mathematics, Will E. Edington, DePauw University; Physics, O. H. Smith, DePauw University; Zoology, T. M. Sonneborn, Indiana University. J. L. Riebsomer, DePauw University, was elected a fellow of the academy.

Saturday was devoted to meetings of the Indiana Society of Taxonomists under the chairmanship of M. S. Markle, Earlham College, and the Indiana Society of Entomologists, with George E. Gould, Purdue University, as chairman.

The Junior Academy of Science, composed of forty high-school science clubs, also held its meetings and exhibits on Saturday under the sponsorship of Howard E. Enders, Purdue University. About three hundred high-school students and teachers were in attendance and a number of papers were presented on their program. A special feature was a lecture and demonstration of liquid air by F. J. Allen, Purdue University. The following officers were chosen for 1942: *President,* James Sarasien, Elmhurst High School, Fort Wayne; *Vice-president,* Jack Moseley, Greencastle High School; *Secretary,* Selma Heaton, Mishawaka High School. Honorary memberships in the American Association for the Advancement of Science were awarded to Don Courtney, Sullivan High School, and Jean Ross, Hammond High School.

The next annual meeting of the academy and the junior academy will be held at Notre Dame University as a part of the Centennial Celebration of that university.

WILL E. EDINGTON,
Press Secretary

DEPAUW UNIVERSITY

SPECIAL ARTICLES

EXPERIMENTAL AIR-BORNE INFECTION WITH POLIOMYELITIS VIRUS[1]

THE work of W. F. Wells and his associates[2] has shown the importance of transmission of both bacterial and virus infections by dried droplet nuclei, such as are formed by evaporation in the air of moist droplets expelled from the nose and mouth. These minute nuclei remain suspended in air for considerable periods of time, during which they constitute a potential source of infection by inhalation. As far as we are aware, the possibility of poliomyelitis being transmitted in this manner has never been put to experimental test, probably because the apparatus and technique developed by Wells have not been widely available. During the past year we have constructed an apparatus based on that of Wells[3] but modified in some respects, with which we have made a number of experiments and obtained some positive results. These, we believe, justify a preliminary report.

Apparatus. The infecting chamber consists of a Monel metal box 18″ × 18″ × 24″ with four port holes with rubber diaphragms through which the heads of the monkeys are inserted. The atomizing apparatus used in the first two series (32 monkeys) was found to give a poor delivery of material into the infecting chamber and was replaced by a better one designed for us by Mr. F. H. Osborn of this city. Compressed air mixed with 5–10 per cent. CO_2 (to increase the depth of respiration) was passed through a flow meter into the atomizer at an average rate of about 6.6 liters per minute, run continuously throughout each experiment. Test runs with suspensions of Chr. prodigiosum showed an even distribution of colonies on plates placed in the position later occupied by the animals' heads—evidence of satisfactory formation and dispersion of droplet nuclei and absence of large, moist droplets.

Animals used. A total of 48 rhesus monkeys (*M. mulatta*) and of 13 cynomolgus monkeys (*M. irus*) have been exposed. Of these, 31 rhesus and 6 cyno-

[1] From the Department of Pediatrics, Stanford University School of Medicine, San Francisco, California. Sponsored by the National Foundation for Infantile Paralysis, Inc.

[2] (a) W. F. Wells, *Am. Jour. Hyg.,* 20: 611, 1934. (b) W. F. Wells and H. W. Brown, *Am. Jour. Hyg.,* 24: 407, 1936. (c) W. F. Wells and M. W. Wells, *Jour. Am. Med. Assn.,* 107: 1698 and 1805, 1936.

[3] W. F. Wells, SCIENCE, 91: 172, 1940.

molgus were subjected to preliminary blockade of the olfactory mucosa with 1 per cent. zinc sulfate solution; and 16 rhesus and 7 cynomolgus were not so treated.

Virus used. The first tests were made with the old MV strain (mixed with the Armstrong strain), kindly supplied by Dr. E. W. Schultz. All other tests in rhesus were made with the O–H strain in the second and third passages (kindly supplied by Dr. James D. Trask). The tests with cynomolgus were made with a recently isolated strain (designated Sab) in the sixth and eighth passages, kindly supplied by Dr. Albert F. Sabin. Supernatant fluid from 20 per cent. suspension of cord was used in amounts varying from 25 to 85 cc for each series of monkeys; the maximum amount available to each monkey based on an assumed even dispersion of nuclei, ranged from 1.6 to 12.1 cc. The actual amount inhaled can not at present be estimated, but was undoubtedly much less than this, since much of the virus in the air must have been evacuated through the exhaust outlet.

The animals, under nembutal anesthesia, were exposed in groups, usually of four, for individual periods of 1–2 hours; repeated in some instances on two or three successive days.

The experiments and the results obtained are summarized in Table 1.

TABLE 1

Series	Virus	Total number	Olfactory blockade				No olfactory blockade				Exposure			
			Number	Polio.	No Polio.	Fever	Number	Polio.	No Polio.	Fever	Number	Total hours	Total virus cc	Virus per monkey cc
Rh I	MVA	16	8	0	8	0	8	0	7	1	1	1	25	1.6
Rh II	O–H[2]	16	8	0	8	0	8	0	5	3	1	1	37	2.3
Rh III	O–H[3]	8	8	1	4	3	..	..	..	..	3	3	75	9.4
Rh IV	O–H[3]	8*	8	1	5	1	..	..	..	..	2	3	75	9.4
Total rhesus		48	32	2	25	4	16	0	12	4				
Cyn I	Sab[6]	7	..	..	..	..	7	6	1	0	2	2	85	12.1
Cyn II	Sab[5]	6	6	2	4	0	..	..	..	..	1	2	40	6.7
Total cynomolgus ..		13	6	2	4	0	7	6	1	0				

* One monkey killed immediately after exposure.

In all, up to the present time, 10 monkeys of the 60 tested have developed typical poliomyelitis, proved by the presence of typical lesions, by subinoculation, or by both. Of these, four had had olfactory blockade and six had not. Of the four with olfactory blockade, two were rhesus and two were cynomolgus. In the positive rhesus experiments, weakness first appeared in the legs, on the seventeenth and eighth days after exposure, respectively, and no bulbar disturbances were observed. The incubation periods in both cynomolgus monkeys were 11 and 14 days to the appearance of paralytic signs. One of these had right facial paralysis and some respiratory difficulty. The other had severe respiratory difficulty, probably of the central type, but no other paralyses. Of seven cynomolgus monkeys in which the olfactory mucosa was not treated with zinc sulphate, six developed poliomyelitis proved by typical histological lesions. The seventh, which escaped, had a severe diarrhea for four weeks after exposure. A fairly uniform symptomatic pattern occurred in all the positive cases of the last series: fever at 4 to 7 days after exposure, followed by tremors and varying amounts of weakness or paralysis, the latter in all cases being in the extremities without apparent involvement of the cranial nerves. Examination of serial sections of the olfactory bulbs showed lesions in all; but in at least two of the cases, these were superficial and slight and no destruction of the mitral cells was found. Such lesions resemble those described by Howe and Bodian[4] in some of their human cases, in which the writers felt that the lesions were secondary rather than primary and probably not indicative of entry through the olfactory portal.

In 4 rhesus monkeys with, and in 4 rhesus without olfactory blockade, transient rises of temperature occurred from 6 to 17 days after exposure, without other evidences of infection except in a few of mild malaise, tremors or ruffling of the fur. One of these was killed; subinoculations from various parts of the central nervous system were all negative; histological examination showed no cellular infiltrations or neuronophagia; in the anterior horns at various levels of the cord, a rather marked satellitosis was noted and a number of ganglion cells showed vacuolization of the cytoplasm. The significance of these changes is not clear. The fever and occasional slight symptoms, however, suggest an abortive type of the disease which can not at present be considered as proved. More complete histological examinations are in progress.

We feel that the successful infection of two rhesus monkeys by inhalation has a special significance in relation to the portal of entry. The olfactory route in both was excluded by the previous blockade of the olfactory mucosa with zinc sulfate and by the

[4] H. A. Howe and D. Bodian, *Bull. Johns Hopkins Hosp.*, 69: 183, 1941.

absence of lesions in the olfactory bulbs as determined by serial sections. The oropharyngeal and gastrointestinal routes can also, in all probability, be considered as excluded on the basis of general experience with the rhesus monkey extending over more than thirty years during which it has been the standard test animal in poliomyelitis research, showing that animals of that species can only be infected non-traumatically by the olfactory route. Several extensive studies, of which those of Clark, Roberts and Preston[5] and of Flexner[6] may be cited, testify to the uniformly negative results of feeding virus to rhesus. It therefore seems highly probable that in the positive inhalation experiments with rhesus here reported, infection entered through the lower respiratory mucosa, at or below the epiglottis. The character of the symptoms in the two positive cynomolgus experiments with olfactory blockade, on the other hand, suggest entry through the oropharynx.

Further work along the same lines is in progress.

Summary

Infection has been obtained in both rhesus and cynomolgus monkeys by inhalation of poliomyelitis virus in the form of droplet nuclei. The olfactory route was excluded in part of the animals successfully infected. The gastrointestinal route is believed to have been excluded in the rhesus monkeys. It seems most probable that the portals of entry were the lower respiratory mucosa in the case of the rhesus monkeys and the oropharyngeal mucosa in the case of the cynomolgus monkeys. Fever and occasional mild symptoms in 8 other rhesus monkeys suggest that an abortive form of poliomyelitis may have resulted from inhalation, but this can not at present be considered as proved. The experiments open up the possibility that human poliomyelitis may, at least sometimes, be an air-borne infection and that the lungs may be a portal of entry. Neither of these aspects of the disease has hitherto, so far as we are aware, been studied experimentally. The presence of virus in the human nasopharynx, which has been repeatedly demonstrated,[7, 8] provides an obvious source of air contamination by patients and carriers; and direct contact has been traced during epidemics in a considerable fraction of cases,[9] amounting to about one third in the report of Top and Vaughan.[10] The relative importance of transmission by air and by ingested material remains to be determined. It would seem probable, however, that both modes of infection must be taken into account.

HAROLD K. FABER
ROSALIE J. SILVERBERG

INHIBITORY EFFECTS OF SULFONAMIDES ON CULTURES OF ACTINOMYCES HOMINIS[1]

PRACTICALLY no information is available on the possible effects of *in vitro* sulfonamides on fungi, although there have been several reports of clinical benefits from the use of sulfonamide drugs in fungous infections.[2] This has resulted in an uncertainty as to whether the effect of the sulfonamides is on the fungi themselves or on secondary bacterial invaders. This paper reports the demonstration of direct inhibitory effects of sulfonamide drugs on cultures of *Actinomyces hominis*.

A stock strain (S) of *Actinomyces hominis* was cultured on Krainsky's glucose agar, and thioglycollate medium.[3] Another strain (M) was isolated on the thioglycollate medium from a draining sinus from the jaw of a patient and thereafter grown on veal agar medium. It differed from the former strain in that the organisms were shorter, seldom branched and often clubbed. The following drugs and concentrations were used: sulfanilamide, sulfathiazole and sulfadiazine,[3] in concentrations of 10, 50 and 100 mg per cent. incorporated in the media before autoclaving. The results obtained may be summarized according to aerobic and anaerobic conditions.

Aerobic Conditions

The S strain grown aerobically on Krainsky's medium was delayed in growth by concentrations of sulfanilamide of 10 and 50 mg per cent. but at the end of one month the growth in both concentrations equalled that of the controls (10 cultures). A concentration of 100 mg per cent., however, completely inhibited growth in some instances and allowed only slight growth in others by the end of one month (7 cultures). Sulfathiazole allowed moderate growth in 10 mg per cent. concentration, slight growth in 50 mg per cent. concentration, and no growth in 100 mg per cent. concentration (9 cultures). The observations in each case extended over one month. The results with

[5] P. F. Clark, D. J. Roberts and W. S. Preston, *Jour. Prev. Med.*, 6: 47, 1932.

[6] S. Flexner, *Jour. Exp. Med.*, 63: 157, 1936.

[7] S. D. Kramer, B. Hoskwith and L. H. Grossman, *Jour. Exp. Med.*, 69: 49, 1939.

[8] A. B. Sabin and R. Ward, *Jour. Exp. Med.*, 73: 771, 1941.

[9] Survey by International Committee for the Study of Infantile Paralysis Organized by Jeremiah Milbank. Williams and Wilkins Company, 1932, pp. 370 *et seq.*

[10] F. H. Top and H. F. Vaughan, Special Report of the Detroit Dept. of Health on Epidemiology of Poliomyelitis in Detroit in 1939.

[1] Aided, in part, by the Rockefeller Fluid Research Fund of the Stanford University School of Medicine.

[2] L. G. Dobson, E. F. Holman and W. C. Cutting, *Jour. Am. Med. Assoc.*, 116: 272, 1941.

[3] We wish to thank the Baltimore Biological Laboratory for supplies of thioglycollate medium, and the Lederle Laboratories for sulfadiazine.

sulfadiazine were similar to those with sulfathiazole (9 cultures).

The S strain was grown on thioglycollate medium for 20 days, at which time there was luxuriant growth in every tube. Autoclaved thioglycollate medium containing sulfanilamide, sulfathiazole or sulfadiazine was then added to the cultures in amounts to make the total drug concentration 50 or 100 mg per cent. (5 results with each drug in each concentration). Fifteen days later the tubes were subcultured. While the controls grew profusely, only 3 cultures from the sulfonamide groups showed any growth at all, and this was minimal. There was no growth in the subcultures of the sulfathiazole or the sulfadiazine tubes.

The M strain, when grown aerobically, gave a plentiful growth in one month. A similar amount of growth, although somewhat slower in development, occurred in cultures containing 10 mg per cent. of sulfanilamide (3 cultures). No growth occurred in cultures containing 50 or 100 mg per cent. sulfanilamide, or 10, 50 or 100 mg per cent. of sulfathiazole or sulfadiazine (3 results with each drug in each concentration).

Thus it is apparent that any of the 3 sulfonamide drugs used more or less completely inhibited the aerobic growth of both strains of actinomyces. Low concentrations were less effective than high, and sulfanilamide was less effective than sulfathiazole or sulfadiazine.

Anaerobic Conditions

The S strain was grown anaerobically on Krainsky's medium in sulfanilamide, sulfathiazole and sulfadiazine, at 10, 50 and 100 mg per cent. concentrations (3 results with each drug in each concentration). Growth was plentiful in the control tubes, and in one of the sulfanilamide (10 mg per cent.) tubes in one month. Of the remaining 26 tubes, 8 showed very slight growth, while 18 showed no growth. The positive growths occurred irregularly in the presence of the various drugs in different concentrations.

The S strain was grown anaerobically on thioglycollate medium with sulfanilamide, sulfathiazole and sulfadiazine in concentrations of 10, 50 and 100 mg per cent. (3 results with each drug in each concentration). In comparison with the vigorous growth in the control tubes in one month, sulfanilamide permitted equally good growth in 10 and 50 mg per cent. concentrations, and poor or no growth in 100 mg per cent. concentrations. Sulfathiazole allowed fair growth in 10 mg per cent. concentrations, poor or none in 50 and 100 mg per cent. concentrations. Sulfadiazine allowed little or no growth at any concentration.

The M strain was grown anaerobically with sulfanilamide, sulfathiazole and sulfadiazine in concentrations of 10, 50 and 100 mg per cent. (3 results with each drug in each concentration). Growth in the control tubes was moderate, and that in sulfanilamide (10 mg per cent. concentrations) was almost as good, but it was absent in all other tubes after one month.

The anaerobic results, therefore, agreed with the aerobic.

Conclusions

(1) Aerobic and anaerobic cultures of two strains of *Actinomyces hominis* were inhibited to some extent by sulfanilamide in a concentration of 10 mg per cent.

(2) Concentrations of 50 and 100 mg per cent. checked growth more or less completely.

(3) Sulfathiazole and sulfadiazine were definitely more effective than sulfanilamide in similar concentrations.

Windsor C. Cutting
Louis P. Gebhardt

School of Medicine,
Stanford University,
San Francisco, Calif.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR ROLLER TUBE TISSUE CULTURE

The roller tube method of tissue culture, originated by Gey[1] and developed by Lewis,[2] is being more and more widely adopted. The apparatus usually employed, consisting of a 1/20 h.p. electric motor, reduction gears and a rotating tube carrier, has several disadvantages. It is expensive and causes more or less noise and vibration. The motor can not be housed inside the incubator because it develops sufficient heat of itself to exceed 38° C. This necessitates a cumbersome apparatus with a shaft running from the motor through the wall of the incubator to the tube carrier.

A relatively simple and inexpensive device which does not have these disadvantages has been successfully used in this laboratory. The apparatus consists of a motor and tube carrier conveniently mounted to form one complete unit.

The general structure of this apparatus is shown in Fig. 1. The motor, A, was obtained from a General Electric clock, of the dressing table type, having an automatic starting mechanism. The motor was detached from the clock and removed from its metal housing. The exposed gears were removed until there

[1] G. O. Gey, *Am. Jour. Cancer*, Vol. 17, 1933.
[2] Warren H. Lewis, Contributions to Embryology No. 150, July, 1935.

remained only the gear on the main drive shaft and two gears connected to it. One of these was found to turn at a speed of 9 revolutions per hour, a satisfactory rate for rotating the cultures. A piece of 1/32 inch sheet brass, B, cut so as to leave the desired gear well exposed, was fastened to the face-posts of

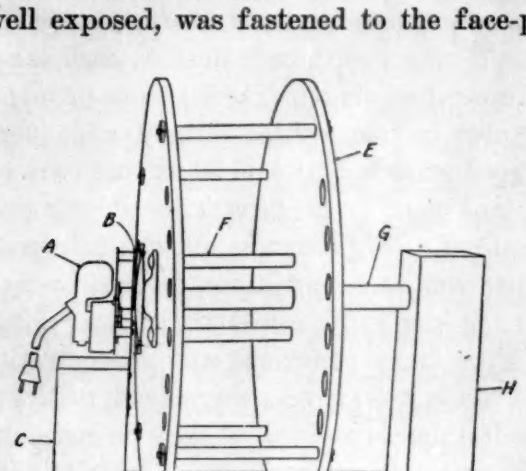

FIG. 1

the clock, and a small hole drilled through this sheet supported the end of the shaft of the intermediate gear. The sheet of metal also served to fasten the motor to its mount, C, a 4 5/16 × 2 × 2 inches wooden post fastened with screws to the 12 × 9 × 3/4 inches plywood base, D.

The roller tube carrier, E, consists of two circular pieces of 1/4 inch plywood, 12 inches in diameter, with eighty-four 5/8 inch holes to accommodate the test-tubes. These wooden discs were mounted on the frame of a bicycle pedal, F, and further secured to each other by 4 metal rods at their peripheries. The distance between the discs so mounted is 3 1/2 inches. The posterior disc was fitted with a cardboard backing with holes 1/2 inch in diameter to prevent the tubes from sliding out of the carrier. The bicycle pedal should be of good construction, about 4 1/2 inches long, with ball bearings. The shaft of the pedal was screwed into a steel bar, G, 4 3/8 inches long, fitted snugly into a hole drilled through a wooden post, H, 7 1/2 × 2 × 2 inches. This post was screwed to the base.

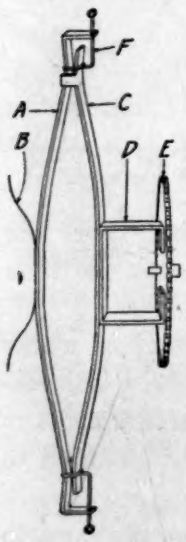

FIG. 2

The motor was attached to the tube carrier, as shown in Fig. 2.

A thin strip of metal, A, 3 inches long and 1/4 inch wide, was soldered to the end of the bicycle pedal, B. A similar strip of metal, C, was soldered to a metal table, D, which was in turn soldered to the face of the clock gear, E. These two metal strips, A and C, were given a tendency to spring apart at the ends, and were clipped together by a sliding wire loop, F, at either end. This connection is sufficiently flexible to center itself as the gear turns and makes unnecessary a precise alignment of the clock gear with the shaft of the pedal. The connection is easily demountable.

The base of the unit is furnished with two thumbscrews at the anterior end for adjusting the tilt of the apparatus necessary to keep the tubes in place and to prevent fluid from wetting the stoppers in the tubes.

This apparatus can be housed in any incubator having adequate interior dimensions and an A.C. electric outlet inside the oven. In our laboratory we use it in a home-made plywood oven which is insulated with rock-wool and heated by thermostatically controlled electric light bulbs. The inside dimensions of this oven are 19 × 15 × 12 inches, and the walls are 3 inches thick. An inexpensive electric temperature control, manufactured by the Lyon Electric Company, San Diego, California, called the Lyon T 22 Breaker, is used. An A.C. outlet is installed in the back wall of the oven into which the roller tube apparatus is plugged.

This unit is silent in operation and produces no vibration. The synchronous motor assures a constant speed. The single unit construction allows the apparatus to be easily transported; it can be used in or out of the incubator as desired and can be changed from one place to another in a few seconds. The total cost of materials used in constructing the apparatus, including the motor, should not exceed seven dollars.

DALE REX COMAN
N. GRAHAM STABLER
McMANES LABORATORY OF PATHOLOGY,
UNIVERSITY OF PENNSYLVANIA MEDICAL SCHOOL

BOOKS RECEIVED

CHAPMAN, V. J. *An Introduction to the Study of Algae.* Pp. x + 387. 209 figures. Macmillan. $3.75.

CLARKE, J. F. GATES. *Revision of the North American Moths of the Family Oecophoridae, with Descriptions of New Genera and Species.* Smithsonian Institution, U. S. National Museum, Washington.

Climate and Man. 1941 Yearbook of Agriculture. Pp. xii + 1248. Illustrated. U. S. Department of Agriculture, Washington. $1.75.

Contributions to Embryology, Vol. XXIX, Nos. 179 to 186. HARTMAN, CARL G. and GEORGE W. CORNER. *The First Maturation Division of the Macague Ovum.* Pp. 193. Illustrated. Carnegie Institution of Washington.

JACKSON, DUNHAM. *Fourier Series and Orthogonal Polynomials.* Carus Mathematical Monograph No. 6. Pp. xii + 234. Open Court Pub. Co., LaSalle, Ill. $2.00.

READ, THOMAS T. *The Development of Mineral Industry Education in the United States.* Pp. xvii + 298. Illustrated. American Institute of Mining and Metallurgical Engineers, New York. $2.00.

SMILEY, DEAN F. and ADRIAN G. GOULD. *Community Hygiene.* Pp. xi + 448. Illustrated. Macmillan. $2.50.

WIDDER, DAVID V. *The LaPlace Transform.* Pp. x + 406. Princeton University Press. $6.00.